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Forestry Division



Forest Health  
Protection  
Report 12-1

# Montana Forest Insect and Disease Conditions and Program Highlights - 2011



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# **MONTANA**

## **Forest Insect and Disease Conditions and Program Highlights – 2011**

**Report 12-01**

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**Mountain pine beetle-killed lodgepole pine in Beaverhead-Deerlodge National  
Forest, courtesy of Brytten Steed, USDA Forest Service**

**Armillaria root disease in Lolo National Forest, courtesy of Blakey Lockman,  
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## ABBREVIATIONS

The following abbreviations are used throughout this document:

<b>Beetles</b>	BWA	= Balsam woolly adelgid, <i>Adelges piceae</i> Ratzeburg
	DFB	= Douglas-fir beetle, <i>Dendroctonus pseudotsugae</i> Hopkins
	ESB	= Spruce beetle, <i>Dendroctonus rufipennis</i> (Kirby)
	FE	= Fir engraver, <i>Scolytus ventralis</i> LeConte
	IPS	= Pine engraver, <i>Ips pini</i> (Say)
	MPB	= Mountain pine beetle, <i>Dendroctonus ponderosae</i> Hopkins
	RTB	= Red turpentine beetle, <i>Dendroctonus valens</i> LeConte
	WBBB	= Western balsam bark beetle, <i>Dryocoetes confusus</i> Swaine
	WPB	= Western pine beetle, <i>Dendroctonus brevicomis</i> LeConte
<b>Defoliators</b>	DFTM	= Douglas-fir tussock moth, <i>Orygia pseudotsugata</i> McDunnough
	GM	= Gypsy moth, <i>Lymantria dispar</i> L.
	LCB	= Larch casebearer, <i>Coleophora laricella</i> Hübner
	PB	= Pine butterfly, <i>Neophasia menapia</i> (Felder & Felder)
	WSBW	= Western spruce budworm, <i>Choristoneura occidentalis</i> Freeman
<b>Hosts</b>	DF	= Douglas-fir
	ES	= Engelmann spruce
	GF	= Grand fir
	LP	= Limber pine
	LPP	= Lodgepole pine
	PP	= Ponderosa pine
	SAF	= Subalpine fir
	WBP	= Whitebark pine
	WL	= Western larch
	WWP	= Western white pine
<b>Other</b>	ADS	= Aerial Detection Survey
	BLM	= Bureau of Land Management
	FIA	= Forest Inventory and Analysis
	FS	= Forest Service
	NF	= National Forest
	NP	= National Park
	IR	= Indian Reservation
	RA	= Reporting Area
	RD	= Ranger District
	TPA	= Trees per acre

## INTRODUCTION

This report summarizes the major forest insect and disease conditions in Montana during 2011 and was jointly prepared by the Montana Department of Natural Resources and Conservation, Forestry Division and USDA Forest Service (FS), State and Private Forestry, Forest Health Protection (FHP), Northern Region.

Information for this report was derived from ground and aerial surveys within Reporting Areas (RA) across parts of Montana. A Reporting Area includes all Federal, State, and private land ownerships within a particular geographic boundary (Figure 1, p. 53).

## HIGHLIGHTS

- Nearly 20.5 million acres of forested lands were surveyed from the air for tree mortality, defoliation, and damage in 2011. This is less than 2010, but included a cross section of land ownership across Montana, including State and private land, nine national forests, two national parks, and six Indian reservations.
- Aerial surveys were conducted around Fort Peck, including parts of Garfield, McCone, Musselshell, Petroleum, and Valley Counties. This area had not previously been surveyed from the air.
- Mountain pine beetle was again the primary mortality agent observed. However, the amount of activity is decreasing statewide with over 1 million acres affected compared with over 2.1 million acres in 2010. Areas in western MT continuing to see high levels of MPB mortality include Lewis and Clark, Powell, and Granite Counties, as well as the Elkhorn Mountains and southern Tobacco Root Mountains. The area between Beaverhead and Ravalli Counties is also seeing significant new activity.
- Defoliation increased in 2011, with area affected by western spruce budworm totaling almost 1.2 million acres. The highest number of acres defoliated by WSBW occurred in the northwest part of the state, including Flathead, Lincoln and Sanders Counties. Defoliation by pine butterfly was detected east of Hamilton. Similar defoliation by this insect was previously recorded in this area in the early 1970's.
- Root disease fungi cause damage and mortality on well over 8 million acres in western Montana, killing more than 30 million trees annually. Root disease-caused mortality is more common west of the Continental Divide.

## SUMMARY OF CONDITIONS

### Bark Beetles

According to aerial and ground survey data, bark beetle activity in Montana declined by nearly half in 2011 from levels reported in 2010 surveys. This is based on aerial surveys of approximately 21.5 million acres of forest land in the state in 2011, compared with 23 million acres surveyed in 2010. Although differences in total acres flown will contribute to changes in total area of detected beetle activity, the change in which areas were flown is likely more influential in the 2011 results. Aerial survey was intensified in the eastern half of Montana in 2011 where beetle activity was significantly lower than areas surveyed in 2010.

The decrease in survey area, as well as differences in recording techniques among aerial surveyors, explains part of this decline in beetle activity. Mortality may have been slightly underestimated in some locations due to late-season crown discoloration (fading) occurring post aerial survey. However, ground observations do indicate a decrease in levels of beetle activity in many areas, especially mountain pine beetle (MPB), with depletion of susceptible host material. Table 2 (p. 42) provides a breakdown by insect and host type of the little more than 1 million acres mapped as infested by bark beetles in 2011.

Mountain pine beetle continues to be the most active bark beetle in the state, although 2011 numbers show continued declines in mortality. Continued cool, wet weather has decreased MPB populations in many areas and supported stronger tree vigor throughout the state, decreasing attack success. Many areas with past activity also have seen decreased mortality due to past losses of most suitable host trees.

Counties with most extensive bark beetle activity where host exists remain include Lewis and Clark, Powell, and Granite. Also notable are the Elkhorn Mountains in Jefferson and Broadwater Counties, the southern Tobacco Root Mountains in Madison County, and the extreme southwest corner of Park County, along the Yellowstone National Park boundary. Scattered mortality appears throughout the host type in Missoula, Ravalli, Cascade, Judith and Gallatin Counties. Although not flown in 2011, field observations also noted significant new activity in Beaverhead County along the southern end of the border with Ravalli County.

Douglas-fir beetle (DFB) population trends declined within certain areas in 2011 relative to 2010 in all national forests and within State, tribal, and private lands. DFB-caused mortality was observed in association with prior western spruce budworm (WSBW) defoliation in Montana within Gallatin, Park, Sweet Grass, and Ravalli Counties through ground surveys. Acres of DFB-caused mortality decreased for these areas in 2011 relative to 2010; this may be due to differences in total areas surveyed or difficulties associated with assessing DFB-caused mortality in trees with prior WSBW defoliation.

DFB populations are at near-endemic levels in most Douglas-fir (DF) and mixed-species stands, except for a few isolated areas where higher populations continued to cause low levels of DF mortality in 2011. While DFB continued to decline across the state in 2011, much of the DF host type has experienced severe WSBW defoliation in recent years. This defoliation, if coupled with unusually warm and dry weather, could promote a resurgence of DFB activity in subsequent years.

Estimates for spruce beetle-caused mortality decreased in 2011 relative to 2010. Beetle populations remained endemic throughout the majority of Montana, except for two locations in south-central Montana. Outbreak populations of spruce beetle continued on federally managed lands in the Gravelly Mountains in Madison County and within the Rock Creek drainage in Carbon County. Ground surveys identified that groups of beetle-caused mortality typically ranged from 2 to 5 trees and were spatially adjacent to 2010-infested Engelmann spruce. Tree mortality is expected to continue in these specific areas in subsequent years.

Western pine beetle (WPB), and Fir engraver (FE) showed little significant activity, with both decreasing in 2011. Both were found at very low levels, likely a continuing result of near normal precipitation for several years.

Pine engraver (IPS) populations and associated tree mortality decreased in 2011 (115 acres, 288 trees) compared to 2010 (663 acres, 2,111 trees). Damage is principally to ponderosa pine (PP), although approximately one-third of the tree damage is to lodgepole pine (LPP).

Approximately 40 percent occurred on private lands. Counties with the majority of small scattered spots included Sanders, Lake, and Cascade. Near or above normal precipitation patterns the past several springs have likely contributed to populations remaining at or near endemic levels.

## Defoliators

The majority of defoliation of forested trees in Montana was caused by western spruce budworm (WSBW), Douglas-fir tussock moth (DFTM), and to a lesser extent pine butterfly. Approximately 600 acres of PP were moderately to severely defoliated by pine butterfly along the Skalkaho Highway, east of Hamilton. Other small areas of defoliation from pine butterfly were identified in the Bitterroot Valley. Outbreak levels of pine butterfly were recorded throughout Ravalli County.

Defoliation from WSBW was recorded in almost every forested county surveyed in Montana in 2011. Number of acres defoliated by WSBW significantly increased from 630,699 in 2010 to almost 1.2 million acres in 2011. The most significant defoliation primarily occurred on national forests that have had periodic outbreaks of WSBW. However, aerial survey recorded the highest number of acres defoliated by WSBW in the northwest part of the state, where significant WSBW outbreaks have not often been recorded. Periodic outbreaks of WSBW usually have occurred on east-side, dry forests of Montana. In 2011, defoliation intensity also increased in many areas where WSBW has been recorded for several years.

In 2010 and 2011, we recorded DFB-caused tree mortality in areas that experienced consecutive, heavy WSBW defoliation over the past few years. The warmer-dry weather pattern in the mid- to late-2000's may have contributed to high levels of defoliation in 2009. Montana has been experiencing more normal temperature and precipitation patterns over the past few years. We expect defoliator activity to decrease if these conditions continue and trees recover from the previous extended drought.

No defoliation from DFTM was recorded via aerial survey in Montana in 2011. However, ground sampling confirmed the presence of outbreak levels of DFTM on parts of the Flathead NF, in Kalispell, and along Flathead Lake. We suspect that some of the acres mapped from aerial survey for WSBW were actually a combination of WSBW and DFTM.

Aerial survey recorded defoliation from unidentified defoliators in Montana. This defoliation occurred across multiple host species and multiple counties. We suspect that WSBW and western hemlock looper may be responsible for some, if not all, of the recorded defoliation.

Cooperative detection monitoring continued for gypsy moth (GM) in 2011 with USDA Animal and Plant Health Inspection Service, Montana Department of Agriculture, Montana Department of Natural Resources and Conservation and US Forest Service. A network of more than 1,000 pheromone-baited traps was placed throughout Montana's forests and urban areas most frequented by travelers. One GM was detected in Billings in 2011.

Balsam woolly adelgid (BWA) is an exotic pest that was only previously detected in areas along the Montana-Idaho border, but is now being seen in other areas of the state. The most obvious indicator of its presence is the white "wool" covered females on the bark of stems and branches of trees during summer months. To date, BWA infections have been observed causing branch

dieback and overall stress in host trees within Montana. Direct mortality caused by BWA has not been documented thus far in Montana; however, severe infestations in other locations such as Idaho have caused tree mortality. BWA has been confirmed through ground surveys in Cascade, Flathead, Gallatin, Granite, Lewis and Clark, Lincoln, Mineral, Ravalli, and Sanders Counties.

## **Root Diseases**

Root diseases are diseases of the site and do not change drastically from one year to the next. Root disease fungi cause damage and mortality on well over 8 million acres in western Montana, killing more than 30 million trees annually. Root disease-caused mortality is more common west of the Continental Divide. Large areas of root disease can be found east of the Divide, but it tends to occur in more discrete patches, rather than being ubiquitous throughout an area. Also, root diseases can be commonly found in riparian areas east of the Continental Divide, often in spruce and subalpine fir. The most impacting root diseases are armillaria root disease (over 6 million acres), laminated root disease (almost 200,000 acres), annosus root disease (almost 2 million acres of fir annosus, and over 100,000 acres of pine annosus), schweinitzii root and butt rot (acreage unknown) and, to a lesser extent, tomentosus root disease (acreage unknown).

## **Foliage Diseases and Tip Blights**

Larch needle diseases were mapped on thousands of acres in western Montana. Over 47,000 acres of larch needle cast were mapped, including 18,619 acres in Flathead County, 11,676 acres in Mineral County, 6,480 acres in Lincoln County, 4,375 acres in Sanders County, 3,486 acres in Lake County, and 2,789 acres in Missoula County. Over 5,600 acres of larch needle blight were mapped, with nearly all the acres in Flathead (5,105 acres) and Sanders (393 acres) Counties.

Rhabdocline needle cast of DF was not mapped by ADS, but was noted on the ground in several plantation settings, including the Eleleham Douglas-fir Test Plantation in the North Fork of the Flathead (MFO-TR-11-24) and the Plains Tree Improvement Area in Plains (MFO-TR-11-31).

Over 300 acres of Diplodia tip blight were identified by ADS; affected acreages were concentrated in Lake County (195 acres) and Missoula County (126 acres).

## **Dwarf Mistletoes**

Historical assessments of dwarf mistletoe infested stands in Montana show that about 16 percent of Douglas-fir, 33 percent of lodgepole pine, and 30 percent of western larch stands are infested with dwarf mistletoe. More recent assessments using Forest Inventory and Analysis data collected on over 50,000 trees across Montana show that only about 1 percent of Douglas-fir, 3.2 percent of lodgepole pine, and 3.9 percent of western larch trees were infected. The clumpy distribution and protracted disease-cycle of dwarf mistletoes allow for impacts across an individual stand to range from none to severe. The clumpy nature of dwarf mistletoe is likely the reason for a discrepancy between these two measurements; the first is measuring infected stands and the second is measuring infected trees.

## **White Pine Blister Rust**

Western white pine, whitebark pine and limber pine are all susceptible to white pine blister rust.

### Western white pine

Mature western white pine (WWP) continues to be killed due to a combination of blister rust and MPB. Lack of suitable sites, either man-made or natural, limits natural regeneration and white pine blister rust may kill a high proportion of natural seedlings. Resistant stock is planted operationally on suitable WWP sites on Federal, State, industrial, and private forest lands throughout northwestern Montana. In addition to planting rust-resistant stock, pruning of the lower bole is an important tool used in blister rust management.

### Whitebark pine

White pine blister rust has been impacting whitebark pine (WBP) ecosystems for many decades. In addition, recent outbreaks of MPB have caused widespread mortality in many WBP stands already impacted by white pine blister rust. The combination of white pine blister rust, bark beetle outbreaks, and lack of natural regeneration due to fire suppression has raised concerns about the long-term viability of WBP ecosystems.

Standardized methodology is now being used to establish monitoring plots in WBP stands throughout the West. These plots are designed to provide a statistically-based assessment of the incidence of white pine blister rust in the ecosystem and the condition of WBP. The Whitebark and Limber Pine Information System, known as WLIS, is a database developed (<http://www.fs.fed.us/r1-r4/spf/fhp/prog/programs2.html>) to compile and provide results of surveys in both WBP and LP. WLIS was expanded to include four other high elevation 5-needle pines during 2011, and will be available in its new format in 2012.

### Limber pine

Limber pine is found at elevations ranging from 2,700 feet near the community of Terry in eastern Montana to around 9,000 feet in and around the Beaverhead-Deerlodge National Forest in southwestern Montana. West of the Continental Divide, LP is largely confined to limited areas adjacent to the Divide, while scattered populations of LP can be found across much of eastern Montana. An area not historically documented as including LP (through FIA or the limber pine-specific studies) is in the Little Rocky Mountains near the community of Harlem in north-central Montana. White pine blister rust is found throughout the distribution of LP, but there are a few areas where LP remains apparently free of the disease, including areas southwest of Ennis and south of Billings. More detailed information about the current amount, distribution, and condition of LP in Montana can be found in the recently published document, *Current Status of Limber Pine in Montana* (Jackson et al. 2010).

## **Abiotic Damage**

Just over 1,300 acres of windthrow were mapped in 2011. These acres were distributed among 10 counties, with most of the acreage in Meagher County (564 acres), Powder River County (295 acres) and Big Horn County (182 acres). Very minor acreages were mapped for flooding damage (150 acres total) and avalanche damage (159 acres) and are duly noted in each affected county.

## ANNUAL AERIAL DETECTION SURVEY

Aerial detection surveys are an overview survey designed to locate and document forest change events, as seen from the air. It is a form of data collection that allows the observer to survey large tracts of forested land in a relatively short period of time. Single engine, high-wing aircraft flying at speeds of approximately 90 to 130 mph at an average altitude of 1,500 feet above ground level are used to contour fly the ridge lines within a Reporting Area (RA). The damage extents or polygons of the aerially detected signatures of recently killed or defoliated trees are marked on a digital sketch mapping system. These polygons are given a code for the agent that likely caused the damage; inferred from the size and species of trees affected, as well as the color and pattern of the damage. The agent code is followed by the total number of trees affected, trees per acre (TPA) affected, or an intensity of the damage (L for light and H for heavy). Areas burned by wildfire are not surveyed until the third year following a fire, as it can be difficult to distinguish mortality caused by fire from that caused by insect or disease activity. The actual amount of mortality from tree diseases, dwarf mistletoes, and white pine blister rust are greatly underestimated with aerial detection surveys because symptoms from these agents can be difficult and, in some instances, impossible to identify from the air.

Much of the data summarized in this report is a product of the annual aerial detection surveys, as well as ground surveys and biological evaluations. The digital data files, data summaries, and aerial detection survey damage maps are available from the Missoula FHP Field Office, in both paper and digital GIS format. Data may also be downloaded at

<http://www.fs.usda.gov/detail/r1/forest-grasslandhealth/?cid=stelprdb5182976>.

The annual aerial detection survey in Montana was conducted from June 20 through September 29, 2011. The survey encompassed approximately 21.5 million acres of mixed ownership forested lands, excluding most designated wilderness areas (Figure 2, p. 54). Four FHP observers, using three contract aircraft, conducted the 2011 aerial survey and identified 2.37 million acres of forest damage in Montana.

## INSECT AND DISEASE CONDITIONS BY COUNTY

### County Results

For each county, damage by ownership is noted and to the extent possible, we have indicated areas affected and an estimate of extent. Counties that are not included had no reported information. Forestland data in the following tables are from the annualized surveys performed by USDA Forest Service Forest and Inventory Analysis (<http://www.fia.fs.fed.us>). In some of our tables, you will observe acres of damage on some ownership where there is no forestland reported. Because of the limited forestland within ownerships of some counties, the density of FIA plots may not have been sufficient at the county level to identify forested acres (i.e. forestland exists but was missed in our sample resulting in an estimate of zero acres). This discrepancy is within their standard of error. Other Federal lands include tribal ownership.

### Beaverhead County

#### Forestland, Mortality, and Defoliation Acres by Ownership (797,487 acres surveyed)

	National Forest	Other Federal	Private	State	Total
<b>Forestland</b>	1,072,813	131,357	41,141	16,607	1,261,918
<b>Dieback</b>	0	3	8	0	11
<b>DFB</b>	39	6	0	0	45
<b>ESB</b>	406	4	2	0	412
<b>MPB-LPP</b>	23,531	3,702	579	1,398	29,210
<b>MPB-PP</b>	0	4	0	2	6
<b>MPB-High Elevation</b>	9,455	813	122	375	10,765
<b>SAF Mortality</b>	2,293	120	44	32	2,489
<b>WSBW</b>	12,116	14,605	3,059	3,660	33,439

The area surveyed in 2011 in Beaverhead County was significantly less than the area surveyed in 2010. Surveys were largely restricted to the southern portion of the county within the Beaverhead and Tendoy Mountains, and a small portion of the Pioneer Mountains in the northern portion of the county. MPB activity declined substantially within these areas but continued to cause damage in LPP and 5-needled pines. MPB-caused mortality was mapped over areas of 200 to 400 acres at low levels (less than 5 TPA). WSBW activity increased to cause severe DF defoliation (greater than 50 percent crown defoliated) throughout the southern portion of the county. Over 30,000 acres were detected with WSBW activity which increased in many new locations.

Avalanche damage (10 acres) was mapped on national forest in the Snowcrest Mountains, northeast of Peterson Basin. White pine blister rust is common in WBP in this county. A site visit to Medicine Lodge Peak documented infection levels of 65 to 76 percent in overstory WBP, and approximately 44 percent in understory WBP (MFO-TR-11-33). Schweinitzii root and butt rot is common in DF, causing decay in the butt logs but not acting as an aggressive root pathogen. Schweinitzii was noted as a significant butt decayer and tomentosus root disease was causing butt and root decay in ES in the Centennial Valley area (MFO-TR-11-33). Lodgepole pine dwarf mistletoe and limber pine dwarf mistletoe are present in the county.

## Big Horn County

### Forestland, Mortality, and Defoliation Acres by Ownership (719,535 acres surveyed)

	National Forest	Other Federal	Private	State	Total
<b>Forestland</b>	0	0	276,536	35,479	312,015
<b>DFB</b>	0	573	2	0	575
<b>ESB</b>	0	2	0	0	2
<b>MPB-LPP</b>	0	2,082	4	0	2,086
<b>MPB-PP</b>	0	474	78	0	551
<b>MPB-High Elevation</b>	0	24	2	0	26
<b>SAF Mortality</b>	0	1,599	2	0	1,601
<b>Unidentified Defoliator</b>	0	212	145	26	383
<b>Wind throw</b>	0	182	0	0	182

Areas surveyed in 2011 within Big Horn County were located on the Crow and Northern Cheyenne Indian Reservations (IRs). On the Crow IR, most of the Pryor Mountains to the west, Bighorn Mountains to the southwest, and Wolf Mountains to the east were surveyed; all of the Northern Cheyenne IR was surveyed. No survey of these areas was conducted in 2010.

MPB is the pest of greatest concern, having killed host pines over 2,600 acres. Lodgepole pine was most affected (almost 2,100 acres), with PP (over 550 acres) and 5-needle pines (26 acres) also affected. Approximately 575 acres of DF were affected by DFB; only traces of ESB activity were detected (3 areas in Rock Creek in the Beartooth Mountains and 1 area in the Pryor Mountains). Mortality of SAF due to a complex of factors was significant (over 1,600 acres). Also of note were the more than 380 acres of unidentified defoliator and more than 180 acres of wind throw.

Geographically, the Pryor Mountains had the majority of windthrow, along with numerous scattered patches of MPB, DFB, subalpine fir mortality, and unknown defoliator. The Big Horn Mountains contained larger areas of damage, including most DFB activity (especially along the eastern headwaters of the Bighorn River), several large areas of SAF mortality, and larger patches of MPB in LPP. The Wolf Mountains (Crow IR) contained most of the large unknown defoliator damage, as well as having numerous spots of MPB activity in PP. Lands on the Northern Cheyenne IR showed mostly scattered, small areas of MPB activity in PP.

Areas of windthrow, totaling 182 acres, were mapped on the Crow IR. These are located south of Pryor and east of Pryor Gap. White pine blister rust is present in the LP in this county. Lodgepole pine dwarf mistletoe and limber pine dwarf mistletoe are also present in the county.

## Blaine County

### Forestland, Mortality, and Defoliation Acres by Ownership (35,696 acres surveyed)

	National Forest	Other Federal	Private	State	Total
<b>Forestland</b>	0	80,430	91,752	0	172,183
<b>Dieback</b>	0	213	0	0	213
<b>DFB</b>	0	2	0	0	2
<b>MPB-LPP</b>	0	152	0	0	153
<b>MPB-PP</b>	0	290	0	14	304
<b>WSBW</b>	0	87	0	0	87

A portion of Blaine County in the Little Rocky Mountains (Fort Belknap IR) was surveyed in 2011; most of this area had also been surveyed in 2010. Agents detected on tribal and private lands included MPB in both LPP and PP (approximately 150 and 300 acres, respectively). Also detected on tribal lands were over 200 acres of aspen dieback, nearly 90 acres of WSBW defoliation in DF, and a trace (2 acres) of DFB.

Lodgepole pine dwarf mistletoe is present in the county.

## Broadwater County

### Forestland, Mortality, and Defoliation Acres by Ownership (78,077 acres surveyed)

	National Forest	Other Federal	Private	State	Total
<b>Forestland</b>	149,833	26,456	101,048	0	277,337
<b>Dieback</b>	0	0	17	0	17
<b>DFB</b>	4	0	0	0	4
<b>MPB-LPP</b>	9,487	29	543	0	10,059
<b>MPB-PP</b>	2	3	1	0	6
<b>MPB-High Elevation</b>	4	0	0	0	4
<b>WSBW</b>	4,432	2,471	1,793	0	8,696

The area surveyed in 2011 in Broadwater County was significantly less than the area surveyed in 2010. Surveys were limited to a small portion of the Elkhorn Mountains in the western portion of the county and MPB activity continued at similar levels within this area in LPP. MPB activity was mapped over large areas of up to 1,000 acres with low (less than 5 TPA) and moderate (up to 30 TPA) levels of mortality. Eastern portions of the county were not surveyed. MPB activity is expected to have continued in LPP and PP, but the extent or severity of damage is not known. WSBW significantly increased as many new areas were mapped with low to moderate levels of defoliation (less than 50 percent crown defoliation).

White pine blister rust has been found in LP in this county. Armillaria root disease is present in the county, and schweinitzii root and butt rot is quite common, especially causing significant decay in the butt logs of larger, older DF. Lodgepole pine dwarf mistletoe is present in the county.

## Carbon County

### Forestland, Mortality, and Defoliation Acres by Ownership (316,198 acres surveyed)

	National Forest	Other Federal	Private	State	Total
<b>Forestland</b>	144,280	105,462	52,065	8,924	310,731
<b>DFB</b>	59	29	38	4	130
<b>ESB</b>	6	1	1	0	8
<b>MPB-LPP</b>	1,936	51	31	0	2,019
<b>MPB-High Elevation</b>	2,153	88	2	0	2,243
<b>SAF Mortality</b>	354	0	0	0	354
<b>WSBW</b>	455	0	125	100	680
<b>Wind throw</b>	32	7	0	0	40

No survey of Carbon County was conducted in 2010. In 2011, forested lands along the eastern edge of the Beartooth Mountains (outside of the Absaroka-Beartooth Wilderness) and the Pryor Mountains, at the eastern side of the county, were surveyed. Of greatest concern in these areas is MPB activity, with over 4,200 acres of pines affected. Acres of LPP and 5-needle pine mortality were similar at over 2,000 each. However, 1.5 times more 5-needle pines were estimated dead on those acres (1.6 TPA versus 1 TPA). Douglas-fir was also affected by WSBW-caused defoliation (approximately 680 acres) and DFB-caused mortality (approximately 130 acres), particularly in the Beartooth area. Over 350 acres of SAF (especially Pryor Mountain area) were affected by a complex of agents. Only a trace of ESB was noted (8 acres), although this beetle has been increasing activity in the state.

Wind throw was noted on approximately 40 acres in both the Beartooth and Pryor Mountains. One area of wind throw is on Custer National Forest, just west of Luther, near the western edge of the county. Another area of wind throw is on the eastern side of the county, just east of Bowler, on the Custer National Forest boundary and partially on BLM lands.

Spruce broom rust and tomentosus root disease in spruce are prevalent in various campgrounds in this county. White pine blister rust is common in WBP and LP. Lodgepole pine dwarf mistletoe and limber pine dwarf mistletoe are present in the county.

## Carter County

### Forestland, Mortality, and Defoliation Acres by Ownership (207,540 acres surveyed)

	National Forest	Other Federal	Private	State	Total
<b>Forestland</b>	74,017	0	51,021	0	125,038
<b>MPB-PP</b>	169	5	54	6	234
<b>Wind throw</b>	22	0	0	0	22

In 2011, areas of the Custer National Forest and private forestlands were surveyed within Carter County; no survey of these areas has occurred for several years. Approximately 235 acres of PP mortality due to MPB activity was mapped. Damage was principally on the national forest, although over 50 acres of damage on private lands was noted, with traces of damage on BLM and State lands.

Also noted was one, 22-acre patch of wind throw on the Custer NF, west of Camp Crook, South Dakota and northeast of Balltower Butte.

## Cascade County

### Forestland, Mortality, and Defoliation Acres by Ownership (262,872 acres surveyed)

	National Forest	Other Federal	Private	State	Total
<b>Forestland</b>	211,400	8,722	98,038	10,127	328,288
<b>MPB-LPP</b>	40,124	100	3,679	184	44,086
<b>MPB-PP</b>	12,762	424	4,915	832	18,933
<b>MPB-High Elevation</b>	2,407	12	36	25	2,480
<b>IPS</b>	2	0	19	0	21
<b>SAF Mortality</b>	287	0	8	0	295
<b>WSBW</b>	44,055	2,776	12,253	1,510	60,594

In Cascade County, the area surveyed in 2011 was approximately half of the area surveyed in 2010. Only a small portion of the Little Belt Mountains in the southeast portion of the county was flown. MPB activity declined substantially in this area but continued to cause low levels of mortality, primarily in LPP and PP hosts. Mortality was typically mapped at less than 5 TPA over broad areas, ranging from 300 to 400 acres. WSBW activity increased to cause severe DF defoliation (greater than 50 percent crown defoliated) throughout the area surveyed. Acres of defoliation detected increased nearly four-fold relative to 2010 levels.

BWA was detected on SAF or GF through ground surveys in this county for the first time in 2011. BWA was detected south of Neihart in the Belt Creek drainage, as well as along Highway 89, just north of the Kings Hill Campground.

A site visit to Malmstrom Air Force Base documented numerous urban forestry problems, including: Dutch elm disease, European elm scales, red band needle blight, terminal weevils, spruce spider mites, ash bark beetles, and other various agents associated with offsite trees (MFO-TR-11-26).

White pine blister rust is common in LP in this county. Armillaria root disease is present in the southeastern portion of the county, and schweinitzii root and butt rot is quite common, causing significant decay in the butt logs of larger, older DF.

## Chouteau County

### Forestland, Mortality, and Defoliation Acres by Ownership (50,708 acres surveyed)

	National Forest	Other Federal	Private	State	Total
<b>Forestland</b>	19,254	0	36,148	1,939	57,341
<b>Dieback</b>	0	65	20	0	85
<b>DFB</b>	0	2	2	0	4
<b>MPB-LPP</b>	0	108	117	0	225
<b>MPB-PP</b>	0	256	386	204	846
<b>WSBW</b>	0	1,333	1,018	104	2,455

In Chouteau County, the area surveyed in 2011 decreased relative to the area surveyed in 2010. Only a small portion of the county in the southern Bears Paw Mountains, Rocky Boy's IR was surveyed. MPB continued to cause mortality in LPP and, to a lesser extent, in PP within tribal lands. MPB activity was observed through ground surveys at moderate levels with numerous groups of 5 to 30 trees killed throughout the Big Sandy Creek and Big Creek

drainages (MFO-TR-11-16). WSBW activity increased in 2011 in areas where no prior defoliation was detected. Defoliation was typically at low to moderate levels (less than 50 percent crown defoliation) in DF host.

Armillaria root disease is present in the northern portion of the county on the Rocky Boy's IR, but appears to be uncommon. Butt rot and breakage caused by *Ganoderma applanatum* has been observed in quaking aspen on the Rocky Boy's IR.

## Custer County

In 2011, 31 acres were surveyed in Custer County on which no damage was observed.

## Deer Lodge County

### Forestland, Mortality, and Defoliation Acres by Ownership (109,154 acres surveyed)

	National Forest	Other Federal	Private	State	Total
<b>Forestland</b>	211,103	8,678	44,188	32,285	296,254
<b>DFB</b>	2	0	8	0	10
<b>MPB-LPP</b>	3,897	0	4,624	389	8,910
<b>MPB-PP</b>	0	0	2	0	2
<b>MPB High Elevation</b>	2	0	426	4	432
<b>WSBW</b>	56	0	128	110	294

Significantly fewer and different areas were surveyed in Deer Lodge County in 2011 relative to areas surveyed in 2010. The area surveyed was primarily within the Flint Creek Range, west of Anaconda in the western portion of the county. In this area, MPB activity generally declined, although mortality continued in LPP and high elevation 5-needled pines. Low levels of WSBW were detected in DF.

White pine blister rust has been found in LP in this county. Schweinitzii root and butt rot is common in DF, causing decay in the butt logs but not acting as an aggressive root pathogen. Lodgepole pine dwarf mistletoe and limber pine dwarf mistletoe are present in the county.

## Fergus County

### Forestland, Mortality, and Defoliation Acres by Ownership (53,438 acres surveyed)

	National Forest	Other Federal	Private	State	Total
<b>Forestland</b>	83,191	178,357	282,094	16,802	560,444
<b>MPB-PP</b>	0	16	34	0	50

In 2011, a small portion of Fergus County, along the border with Garfield County (north end) was flown as part of a survey of the larger Fort Peck area. No survey of this area was done in 2010, nor has an aerial survey for insect activity been done in the Fort Peck area previously. Approximately 50 acres of MPB activity in PP were noted, mostly on private lands with some activity noted on BLM managed lands and a trace on FWP managed areas. The Judith and Snowy Mountain ranges surveyed in 2010 were not surveyed in 2011.

Root disease patches, assumed to be Armillaria root disease, have been noted in the Big Snowy Mountains. Armillaria root disease was positively identified in the North Moccasin Mountains, north of Lewistown. Lodgepole pine dwarf mistletoe is present in this county.

## Flathead County

### Forestland, Mortality, and Defoliation Acres by Ownership (1,836,610 acres surveyed)

	National Forest	Other Federal	Private	State	Total
<b>Forestland</b>	1,680,148	519,715	418,105	154,800	2,772,768
<b>Avalanche</b>	97	0	0	0	97
<b>Dieback</b>	8	0	0	0	8
<b>Diplodia Canker</b>	0	0	2	0	2
<b>DFB</b>	216	515	146	241	1,118
<b>ESB</b>	6	8	4	0	18
<b>FE</b>	36	2	12	2	52
<b>Larch Needle Blight</b>	973	3,794	338	0	5,105
<b>Larch Needle Cast</b>	17,005	0	1,137	477	18,619
<b>MPB-LPP</b>	2,128	5,306	1,737	811	9,982
<b>MPB-PP</b>	30	74	134	36	274
<b>MPB-WP</b>	77	0	0	0	77
<b>MPB-High Elevation</b>	26	2	2	0	30
<b>IPS</b>	0	0	2	2	4
<b>SAF</b>	2,236	184	46	54	2,520
<b>WSBW</b>	89,737	66,762	34,323	15,612	206,434

About 30 percent fewer acres were flown in Flathead County in 2011 than in 2010. In 2011, a large portion of the county in the southwest was not flown. Despite less area surveyed, defoliation from WSBW increased nearly four-fold in 2011. WSBW increased in intensity across most parts of the county included in the survey. WSBW activity also increased in acres and intensity on the western edge of Glacier National Park, especially near Kintla and Bowman lakes and west of the North Fork of the Flathead River.

Other defoliators, including DFTM, are causing significant levels of defoliation on host trees in the Flathead Valley. DFTM caused high levels of defoliation in Douglas-fir in the Kalispell area and in the Big Fork Tree Improvement Plantation in Big Fork. High populations of caterpillars were also reported along Flathead Lake and in Columbia Falls. In some cases, WSBW, DFTM, and western hemlock looper were detected in the same tree.

The majority of the area where MPB was detected in 2010 was not included in the 2011 aerial survey. However, ground surveys indicate that MPB is continuing in many areas at levels similar to 2010. MPB activity continued near the Hungry Horse Reservoir, especially near the southern end in LPP.

BWA was detected on SAF or GD through ground surveys in this county for the first time in 2011. BWA was detected north of Hungry Horse Reservoir where Emery and Oliver Creeks converge.

Large areas of larch needle cast, totaling over 18,000 acres, were mapped throughout the county, but were concentrated on the Flathead National Forest, west of Glacier NP and on the

southwest edge of the county. Larch needle blight was mapped on over 5,000 acres, mostly on FS lands (3,794 acres) west of Glacier NP. Almost 40 acres of avalanche damage was mapped in Glacier NP in the Livingston Range, near Summit Mountain in the Lewis Range at south end of the park, and in the Apgar Mountains northwest of West Glacier. Over 60 acres of avalanche damage were mapped on the national forest in the Whitefish Range, west of Polebridge, and in the Swan Range, west of Hungry Horse Reservoir.

Significant Rhabdocline needle cast was noted in the Elelehan Douglas-fir Test Plantation in the North Fork of the Flathead River drainage (MFO-TR-11-24). White pine blister rust is common in both WWP and WBP in this county. Root diseases are common in counties west of the Continental Divide. The more common ones known to occur in this county are s-type annosus root disease, armillaria root disease, and schweinitzii root and butt rot. The tree species most affected are DF and true firs. P-type annosus root disease is known to occur in PP. Douglas-fir dwarf mistletoe, lodgepole pine dwarf mistletoe and western larch dwarf mistletoe are present and common in this county.

## Gallatin County

### Forestland, Mortality, and Defoliation Acres by Ownership (851,644 acres surveyed)

	National Forest	Other Federal	Private	State	Total
<b>Forestland</b>	585,049	77,463	199,570	6,281	868,362
<b>Dieback</b>	38	0	114	0	152
<b>DFB</b>	51	2	23	4	80
<b>Flooding</b>	4	0	0	0	4
<b>MPB-LPP</b>	20,097	5,275	6,121	1,648	33,140
<b>MPB-PP</b>	2	0	2	2	6
<b>MPB-High Elevation</b>	7,634	175	911	7	8,728
<b>SAF</b>	206	54	96	0	356
<b>WSBW</b>	8,657	120	18,458	925	28,160

The majority of Callatin County was flown in both 2011 and 2010. MPB activity declined in 2011; half as many acres were detected with LPP and 5-needed pine mortality relative to 2010. Ground surveys indicated MPB-caused mortality was reduced to scattered individual trees and small groups within the Bridger Mountains and Hebgen Lake areas (MFO-TR-11-14). Mortality continued within the Gallatin Canyon area at low to moderate levels within LPP and to a lesser extent to 5-needed pines.

In 2011 WSBW activity continued at similar levels of damage as mapped in 2010. The severity of WSBW-caused defoliation decreased in multiple areas, including the Bridger Mountains and near Hebgen Lake (MFO-TR-11-14). DFB activity appeared to have been reduced in 2011. However, activity may be underestimated due to extensive WSBW defoliation in DFB host trees. DFB activity was noted in small groups of trees that had severe WSBW defoliation near Hebgen Lake and the Bridger Mountains (MFO-TR-11-14).

BWA was detected on SAF or GF through ground surveys in this county for the first time in 2011. BWA has been detected in multiple locations south of Hebgen Lake within the Denny Creek drainage and near Targhee Pass. BWA was also noted in Gallatin Canyon, within the Moose Creek drainage where National Forest Roads 479 and 6959 intersect; in the Bridger Mountains, within the Fairy Creek drainage just east of Fairy Lake; and in Hyalite Canyon, where Blackmore Creek converges with Hyalite Reservoir.

Two very small polygons (4 acres total) of flood damage were noted on the national forest just southwest of West Yellowstone. Schweinitzii root and butt rot and tomentosus root disease are commonly found causing butt decay in spruce, DF, and SAF and contributes to wind throw. Fir broom rust is common in numerous campgrounds in the county. Lodgepole pine dwarf mistletoe is common and is at high levels near Hebgen Lake.

White pine blister rust is common in WBP and LP. Black stain root disease has been identified from DF, but is considered of minor importance. Limber pine dwarf mistletoe is present in the county.

## Garfield County

### Forestland, Mortality, and Defoliation Acres by Ownership (776,553 acres surveyed)

	National Forest	Other Federal	Private	State	Total
<b>Forestland</b>	0	120,216	51,825	9,618	181,659
<b>DFB</b>	0	2	0	0	2
<b>MPB-PP</b>	0	110	53	10	173
<b>Unidentified defoliat.</b>	0	0	2	0	2

In 2011, a strip along the northern border of Garfield County was flown as part of a survey of the larger Fort Peck area. No survey of this area was done in 2010, nor has an aerial survey for forest insect activity been done in this area previously. The principle damage agent detected was MPB in PP. Of the 173 acres affected, most acres were on BLM managed lands, although 53 acres of private lands and 10 acres of FWP managed lands were affected. Traces (approximately 2 acres each) of other activity included DFB caused mortality on BLM managed lands and an unidentified defoliator on private lands.

## Glacier County

### Forestland, Mortality, and Defoliation Acres by Ownership (100,653 acres surveyed)

	National Forest	Other Federal	Private	State	Total
<b>Forestland</b>	33,937	226,013	158,432	0	418,382
<b>Avalanche</b>	0	23	0	0	23
<b>DFB</b>	18	2	0	0	20
<b>Flooding</b>	0	4	0	0	4
<b>MPB-LPP</b>	301	310	175	0	786
<b>MPB-PP</b>	6	0	2	0	8
<b>SAF</b>	0	292	0	0	292
<b>WSBW</b>	0	673	0	0	673

A small area in the southwestern portion of Glacier County was surveyed in 2011. Within this area, MPB activity decreased substantially in LPP. Ground-based surveys indicated this decline also occurred in areas not flown in western portions of the Blackfoot IR. Low levels of DFB activity continued east of Saint Mary in trees with high levels of prior WSBW defoliation (MFO-TR-11-15).

WSBW activity also decreased in the western portion of the county. Overall, WSBW caused low levels of defoliation in new foliage in affected DF that were typically less than 10 percent defoliated.

A 23-acre patch of avalanche damage was mapped in the very southern portion of Glacier NP, on the east side of the Continental Divide. Four acres of flood damage was mapped in the southern portion of Glacier NP, also east of the Continental Divide.

White pine blister rust is common in WBP and LP. Armillaria root disease is known to be a significant pathogen in DF in the western portion of the county on the Blackfeet IR. Lodgepole pine dwarf mistletoe and western larch dwarf mistletoe are present in this county.

## Golden Valley County

### Forestland, Mortality, and Defoliation Acres by Ownership (31,441 acres surveyed)

	National Forest	Other Federal	Private	State	Total
<b>Forestland</b>	8,184	0	63,511	0	71,695
<b>MPB-PP</b>	0	0	2	26	28

In 2011, the surveyed area within Golden Valley County was in the Bull Mountains. Twenty eight acres of MPB in PP (two acres on State lands and 26 acres on private lands) were detected. With no previous recent survey along this southeast border, no trend in pest activity can be determined. However, 2011 data shows MPB is active in PP on both private and State lands.

## Granite County

### Forestland, Mortality, and Defoliation Acres by Ownership (432,603 acres surveyed)

	National Forest	Other Federal	Private	State	Total
<b>Forestland</b>	585,795	26,809	190,740	42,302	845,646
<b>DFB</b>	104	9	103	4	220
<b>MPB-LPP</b>	66,367	4,641	9,126	838	80,972
<b>MPB-PP</b>	2,175	186	4,271	482	7,114
<b>MPB-High Elevation</b>	68	0	0	0	68
<b>SAF</b>	6	0	0	0	6
<b>Unidentified Defoliator</b>	111	0	21	0	132
<b>WSBW</b>	3,919	1,639	1,939	1	7,498

Similar numbers of acres, but in some cases different areas, were flown in Granite County in 2011 as in 2010. MPB activity remained at similar levels between 2010 and 2011. The intensity (TPA killed), however, declined in some areas. The decrease in these areas is due to host depletion. MPB activity also continued near Georgetown Lake and Philipsburg at similar levels as in 2010. Ground surveys confirm that MPB is still active near East Fork Reservoir and that plenty of host type is still available. MPB activity in PP increased in parts of the county. Weather patterns in 2012 will, in part, determine if MPB continues to decline or increase again in 2012 in these areas.

WSBW activity continued in 2011 and the intensity of defoliation increased in most areas flown.

BWA was detected on SAF or GF through ground surveys in this county for the first time in 2011. BWA was detected southwest of Georgetown Lake, along Middle Fork Road, where Placer and Middle Fork Rock Creeks converge.

Root diseases are common in counties west of the Continental Divide. The more common ones known to occur in this county are s-type annosus root disease, armillaria root disease, and schweinitzii root and butt rot. The tree species most affected are DF and true firs. P-type annosus root disease is known to occur in PP. Elytroderma needle disease is a significant agent in PP in localized areas in this county. Lodgepole pine dwarf mistletoe and western larch dwarf mistletoe are also present in this county.

## Hill County

### Forestland, Mortality, and Defoliation Acres by Ownership (15,204 acres surveyed)

	National Forest	Other Federal	Private	State	Total
<b>Forestland</b>	0	0	35,016	0	35,016
<b>Dieback</b>	0	17	0	0	17
<b>MPB-LPP</b>	0	613	62	0	675
<b>MPB-PP</b>	0	36	16	0	52
<b>WSBW</b>	0	30	0	0	30

Armillaria root disease is present in the southern portion of Hill County on the Rocky Boy's IR, but appears to be uncommon. Lodgepole pine dwarf mistletoe is present in this county.

## Jefferson County

### Forestland, Mortality, and Defoliation Acres by Ownership (688,669 acres surveyed)

	National Forest	Other Federal	Private	State	Total
<b>Forestland</b>	430,785	60,017	118,707	16,380	625,889
<b>DFB</b>	6	2	4	0	12
<b>MPB-LPP</b>	18,900	1,337	1,611	10	21,858
<b>MPB-PP</b>	4,092	1,353	2,701	334	8,480
<b>MPB-High Elevation</b>	15	0	1	0	16
<b>SAF</b>	6	0	0	0	6
<b>WSBW</b>	23,868	7,327	20,464	726	52,385

Similar numbers of acres in Jefferson County were flown in 2010 and 2011. MPB activity decreased in the county in both acres affected and the number of TPA killed in both LPP and PP. Ground observations from areas around Park Lake show MPB has greatly depleted quality LPP host trees. Loss of host has likely contributed to overall declines in MPB activity. WSBW significantly increased in 2011 from just over 1,000 to 50,000 acres.

White pine blister rust has been found in LP.

## Judith Basin County

### Forestland, Mortality, and Defoliation Acres by Ownership (456,377 acres surveyed)

	National Forest	Other Federal	Private	State	Total
<b>Forestland</b>	272,020	0	20,434	8,370	300,824
<b>Dieback</b>	0	0	91	0	91
<b>DFB</b>	155	0	0	0	155
<b>ESB</b>	4	0	0	0	4
<b>MPB-LPP</b>	37,257	414	2,079	2	39,752
<b>MPB-PP</b>	6,447	208	3,696	388	10,739
<b>MPB-High Elevation</b>	9,180	14	314	18	9,526
<b>IPS</b>	23	0	0	2	25
<b>SAF</b>	1,907	0	25	0	1,932
<b>WSBW</b>	83,883	2,552	10,452	532	97,419
<b>Wind throw</b>	14	0	0	0	14

Almost twice as many acres were flown in Judith Basin County in 2011 compared to 2010. MPB activity continued in both LPP and PP. Ground observations in the Little Belt Mountains, Kings Hill area confirm continued MPB activity, although many of the large WBP and LPP were killed several years earlier. WSBW activity significantly increased in both acres affected and intensity of defoliation in 2011. Subalpine fir mortality also increased in 2011.

Two areas of wind throw totaling 14 acres were mapped on national forest on the very western edge of the county, near Peterson Mountain, and northwest of the Dry Wolf Trailhead.

White pine blister rust is common in LP. Tomentosus root disease is known to be significant in some campgrounds. Lodgepole pine dwarf mistletoe is present in this county.

## Lake County

### Forestland, Mortality, and Defoliation Acres by Ownership (743,730 acres surveyed)

	National Forest	Other Federal	Private	State	Total
<b>Forestland</b>	174,128	0	336,476	41,207	551,811
<b>Avalanche</b>	0	2	0	0	2
<b>Diplodia Canker</b>	0	50	120	24	194
<b>DFB</b>	126	78	89	44	337
<b>FE</b>	6	31	44	3	84
<b>Flooding</b>	0	0	32	11	43
<b>Larch Needle Blight</b>	0	73	7	0	80
<b>Larch Needle Cast</b>	3,002	22	148	314	3,486
<b>MPB-LPP</b>	2,748	175	368	381	3,672
<b>MPB-PP</b>	132	347	191	144	814
<b>IPS</b>	0	8	4	0	12
<b>SAF</b>	12	50	8	4	74
<b>WSBW</b>	32,446	850	11,699	10,834	55,829
<b>Wind throw</b>	0	67	0	2	69

Approximately twice as many acres were flown in 2011 in Lake County compared to 2010. MPB activity decreased in 2011 across forested lands flown, continuing at low levels in scattered pockets near Swan Lake and along the southern boundary of the Flathead IR in 2011.

Acres defoliated by WSBW significantly increased in the northeast portion of the county, in the area surrounding Swan Lake. About 50 percent of acres were recorded as high levels of defoliation. DFTM was not detected by aerial detection survey but ground surveys indicated high populations of DFTM along the west side of Flathead Lake. In some cases, WSBW, DFTM, and western hemlock looper were detected in the same tree.

Just under 200 acres of Diplodia tip blight were mapped on private, State, and Flathead IR lands in the center and western portions of this county during 2011, a significant decrease from the 1,500 acres mapped in 2010. Eighty acres of larch needle blight were mapped, mostly on the Flathead IR southwest of Elmo. One small area was noted near Lake Mary Ronan. Over 3,000 acres of larch needle cast were mapped on national forest and another 462 acres were mapped on private and tribal lands, and were concentrated in the eastern portion of the county. A 43-acre area of flood damage was mapped on the Stillwater State Forest and private lands, just west of Highway 83. Several areas of wind throw, totaling 67 acres, were mapped on tribal lands, just west of Arlee, and another 2 acres of wind throw were mapped in the middle of the State lands section, just northeast of Arlee.

White pine blister rust is common in both WWP and WBP. Root diseases are common in counties west of the Continental Divide. The more common ones known to occur in this county are s-type annosus root disease, armillaria root disease, and schweinitzii root and butt rot. The tree species most affected are DF and true firs. P-type annosus root disease is known to occur in PP. Elytroderma needle disease is a significant agent in PP in localized areas in this county. Douglas-fir dwarf mistletoe, lodgepole pine dwarf mistletoe, and western larch dwarf mistletoe are present in this county.

## Lewis and Clark County

### Forestland, Mortality, and Defoliation Acres by Ownership (668,040 acres surveyed)

	National Forest	Other Federal	Private	State	Total
<b>Forestland</b>	991,403	35,287	339,120	37,521	1,403,331
<b>Dieback</b>	0	0	0	43	43
<b>DFB</b>	789	4	236	163	1,192
<b>ESB</b>	2	0	0	0	2
<b>FE</b>	2	0	0	0	2
<b>MPB-LPP</b>	105,156	3,378	15,719	2,385	126,638
<b>MPB-PP</b>	4,796	2,642	16,459	2,842	26,739
<b>MPW-High Elevation</b>	66	0	0	2	68
<b>IPS</b>	0	0	2	0	2
<b>SAF</b>	21	0	0	0	21
<b>WPB</b>	0	0	4	0	4
<b>WSBW</b>	117,412	12,979	56,367	7,560	194,318

About half of acres flown within Lewis and Clark County in 2010 were also flown in 2011. High levels of damage caused by MPB and WSBW were recorded in 2011. MPB-caused mortality continued in all species of pines and was at similar intensity levels in most parts of the county, except for the southern and eastern portions. Ground observations indicate that in the southern portion of the county (e.g. Boulder Mountains) MPB activity may be decreasing due to host depletion in LPP. However, in other areas of the county, given proper weather conditions, sufficient PP host exists to maintain MPB populations.

Acres defoliated by WSBW greatly increased, with defoliation found on over 194,000 acres and severity of defoliation increasing dramatically. DFB activities continued in 2011 and were commonly found in areas where trees were heavily defoliated by WSBW.

BWA was detected on SAF or GF through ground surveys in this county for the first time in 2011. BWA was detected southwest of Helena, east of Lee Mountain, where Tenmile and Banner Creeks converge. BWA was also noted east of Lincoln, where Stemple Pass Road crosses Gold Creek.

Armillaria root disease is present in the southeastern portion of the county, and schweinitzii root and butt rot is quite common, causing significant decay in the butt logs of larger, older DF. White pine blister rust is common in WBP and LP. Lodgepole pine dwarf mistletoe is present and common in this county.

## **Liberty County**

Aerial detection surveys were not conducted in Liberty County during 2011. White pine blister rust occurs on WBP and LP. Lodgepole pine dwarf mistletoe is present in this county.

## **Lincoln County**

### **Forestland, Mortality, and Defoliation Acres by Ownership (1,143,291 acres surveyed)**

	<b>National Forest</b>	<b>Other Federal</b>	<b>Private</b>	<b>State</b>	<b>Total</b>
<b>Forestland</b>	1,749,728	0	376,569	42,321	2,168,618
<b>DFB</b>	567	0	31	16	614
<b>FE</b>	26	0	2	0	28
<b>Larch Needle Cast</b>	6,272	0	208	0	6,480
<b>MPB-LPP</b>	5,831	0	978	151	6,960
<b>MPB-PP</b>	1,114	2	207	4	1,327
<b>MPW-High Elevation</b>	4	0	0	0	4
<b>SAF</b>	592	0	3	20	615
<b>WSBW</b>	62,551	0	3,935	119	66,605

Only the northwest portion of Lincoln County was flown in 2011; about 50 percent of the acres flown in 2010. MPB activity appears to have increased in 2011, especially in LPP. Large groups of 75 to 100 LPP were mapped as killed by MPB in 2011. MPB activity in other species of pine, including PP, continued. MPB activity continued in and around Libby and Lake Koocanusa. Aerial surveys were not flown in the area east of Lake Koocanusa in 2011; however, during a site visit we found low and scattered levels of current MPB activity near the lake and in forested areas surrounding Libby. The most significant increase in MPB activity was in the northwest portion of the county near the county line.

WSBW increased between 2010 and 2011. Large areas of defoliation were recorded in most parts of the county that had susceptible host type. DFB activity slightly increased in 2011 and may be in response to the large expanses of host type heavily defoliated by WSBW. Subalpine fir mortality declined in 2011.

BWA was detected on SAF or GF through ground surveys in this county for the first time in 2010. BWA was detected east of Libby, along Cripple Horse Creek, south of Warland Peak and south of Bull Lake, near Ross Creek where National Forest Road 398 meets Highway 56. BWA was also noted west of Lake Koocanusa, near Obermayer Lake Dam within the Pete Creek Campground.

During the 2011 ADS, almost 6,500 acres of larch needle cast were mapped throughout the northwest portion of the county. Most of this damage was on national forest, but a little over 200 acres were on private lands.

Root diseases are common in counties west of the Continental Divide. The more common ones known to occur in this county are s-type annosus root disease, armillaria root disease, and schweinitzii root and butt rot. The tree species most affected are DF and true firs. P-type annosus root disease is known to occur in PP. Armillaria root disease was causing notable damage in DF in several places in the county, including southeast of Eureka, off the Glen Lake Road (MFO-TR-11-25) and in the Five Mile Recreation Area, east of Lake Koocanusa (MFO-TR-11-19). Also noted in the Five Mile Recreation Area was Schweinitzii root and butt rot that contributed to the failure of DF. Armillaria root disease was found to be causing significant mortality in off-site PP near the Troy Shooting Range (MFO-TR-11-06), and impacting planted WWP in the Spread Creek Test Plantation near Troy (MFO-TR-11-09). Lophodermium needle cast in WWP and needle desiccation from winter damage were also found in the Spread Creek Test Plantation (MFO-TR-11-09). Annosus root disease was identified in a stand near Swamp Creek, east of Lake Koocanusa (MFO-TR-12-02).

White pine blister rust is common in both WWP and WBP. Douglas-fir dwarf mistletoe, lodgepole pine dwarf mistletoe, and western larch dwarf mistletoe are present in this county.

## Madison County

### Forestland, Mortality, and Defoliation Acres by Ownership (1,125,447 acres surveyed)

	National Forest	Other Federal	Private	State	Total
<b>Forestland</b>	598,215	96,634	139,715	9,272	843,836
Avalanche	24	0	0	0	24
Dieback	2	0	4	0	6
DFB	183	2	12	0	197
ESB	2,595	26	40	2	2,663
MPB-LPP	64,185	5,866	3,336	722	74,109
MPB-PP	41	2	6	0	49
<b>MPB-High Elevation</b>	25,696	938	2,309	31	28,974
SAF	16,076	601	307	69	17,052
WSBW	25,631	2,893	4,843	928	34,295
Wind throw	24	0	0	0	24

Similar numbers of acres were flown in Madison County in 2010 and 2011. MPB was by far the most damaging insect agent recorded in 2011. In the county, approximately 100,000 acres of pines experienced mortality in each of 2010 and 2011. Most of the MPB-caused tree mortality was concentrated in the Gravelly, Snow Crest, and Tobacco Root Mountain Ranges.

WSBW also increased in areas that were flown. The most significant levels of defoliation occurred in the central and southern portions of the county. Subalpine fir mortality also appears to have increased. SB activity continued in areas where susceptible, large-diameter spruce occurred in the southern Gravelly Range.

A 24-acre area of avalanche damage was mapped on national forest in the Snowcrest Range near Stonehouse Mountain, and a 24-acre area of wind throw was mapped in the Lee Metcalf Wilderness, east of Ennis Lake.

White pine blister rust is common in WBP and LP. Limber pine dwarf mistletoe is present in this county.

## **McCone County**

In 2011, 142,939 acres of McCone County were surveyed along the northern portion of its border with Garfield County as part of a survey of the larger Fort Peck area. No survey of this area was done in 2010, nor has an aerial survey for forest insect activity been done in this area previously. No damage agent activity was recorded for this area, although other portions of the Fort Peck survey did show MPB activity on PP.

## **Meagher County**

### **Forestland, Mortality, and Defoliation Acres by Ownership (111,892 acres surveyed)**

	<b>National Forest</b>	<b>Other Federal</b>	<b>Private</b>	<b>State</b>	<b>Total</b>
<b>Forestland</b>	454,395	0	212,692	17,536	684,623
<b>DFB</b>	4	0	0	0	4
<b>MPB-LPP</b>	1,495	0	61	0	1,556
<b>MPB-PP</b>	0	0	1,046	114	1,160
<b>MPW-High Elevation</b>	210	0	0	0	210
<b>IPS</b>	0	0	2	0	2
<b>SAF</b>	3	0	0	0	3
<b>WSBW</b>	496	0	6,219	222	6,937
<b>Wind throw</b>	564	0	0	0	564

A small area in the central and southeastern portions of Meagher County was surveyed in 2011. From this limited survey, MPB activity appeared to have decreased in the southeastern portion of the county in the Castle Mountains. However, activity levels are unknown in other areas such as the Little Belt Mountains, where extensive activity occurred in 2010.

WSBW activity increased to cause severe defoliation in scattered portions of areas surveyed in the Castle and Little Belt Mountains.

During the 2011 ADS, a large 564-acre area of wind throw was mapped on national forest in the Crazy Mountains, in the headwaters of Shields River, north of the Shields River Recreation Site. White pine blister rust occurs on LP in this county, and was found to be prevalent in WBP in the upper portions of Showdown Ski Area (MFO-TR-10-06).

Armillaria root disease is present in the county, and schweinitzii root and butt rot is quite common, especially causing significant decay in the butt logs of larger, older DF. Tomentosus root disease is known to be significant in some campgrounds in this county, mostly affecting spruce.

Lodgepole pine dwarf mistletoe is present and common in this county.

## Mineral County

### Forestland, Mortality, and Defoliation Acres by Ownership (568,173 acres surveyed)

	National Forest	Other Federal	Private	State	Total
<b>Forestland</b>	637,014	0	80,646	17,948	725,608
<b>DFB</b>	246	0	17	5	268
<b>ESB</b>	2	0	0	0	2
<b>FE</b>	12	0	0	0	12
<b>Larch Needle Cast</b>	11,597	0	79	0	11,676
<b>MPB-LPP</b>	15,370	0	252	214	15,836
<b>MPB-PP</b>	5,760	0	469	135	6,364
<b>IPS</b>	2	0	0	0	2
<b>SAF</b>	100	0	2	0	102
<b>WSBW</b>	128	0	0	0	128

Substantially more area within Mineral County was surveyed in 2011 relative to 2010. MPB activity continued in LPP and PP host types throughout the Bitterroot Mountains. MPB-caused mortality was widespread at low levels (less than 5 TPA) across areas that were typically 50 to 150 acres. WSBW activity was at minimal levels in 2011 and decreased in the eastern portion of the county where activity was noted in 2010.

BWA was detected on SAF or GF through ground surveys in this county for the first time in 2010. BWA was detected southwest of Superior, where Cedar and Rabbit Creeks converge, as well as further south near the American Gulch Mine. BWA was also noted in multiple locations east of Henderson, where the Old Mullan Road meets Twelvemile Road.

During the 2011 ADS, almost 12,000 acres of larch needle cast were mapped, mostly on national forest (11,597 acres). It was especially concentrated in the northern portion of the county and on the border with Idaho.

White pine blister rust is common in both WWP and WBP. Root diseases are common in counties west of the Continental Divide. The more common ones known to occur in this county are s-type annosus root disease, armillaria root disease, laminated root disease, and schweinitzii root and butt rot. The tree species most affected are DF and true firs. Tomentosus root disease has been found impacting western larch trees that are heavily infected with larch dwarf mistletoe. P-type annosus root disease is known to occur in PP. Douglas-fir dwarf mistletoe, lodgepole pine dwarf mistletoe, and western larch dwarf mistletoe are present in this county. Annosus root disease was found to be significantly impacting GF near Camel's Hump, north of St. Regis (MFO-TR-11-22). This same area also has significant amounts of armillaria root disease impacting DF and GF.

## Missoula County

### Forestland, Mortality, and Defoliation Acres by Ownership (992,832 acres surveyed)

	National Forest	Other Federal	Private	State	Total
<b>Forestland</b>	673,763	17,621	571,755	133,415	1,396,554
<b>Diplodia Canker</b>	0	121	5	0	125
<b>DFB</b>	356	12	86	0	454
<b>FE</b>	0	0	4	0	4
<b>Larch Needle Blight</b>	0	35	0	0	35
<b>Larch Needle Cast</b>	1,268	37	1,484	0	2,789
<b>MPB-LPP</b>	22,241	8,003	9,487	6,578	46,309
<b>MPB-PP</b>	2,991	719	8,850	11,624	24,184
<b>MPB-High Elevation</b>	0	6	0	0	6
<b>IPS</b>	0	15	2	0	17
<b>SAF</b>	69	95	16	0	180
<b>WSBW</b>	3,513	3,840	15,036	17,622	40,011
<b>Wind throw</b>	0	58	0	0	58

In 2011, surveys occurred in the northeastern part of Missoula County within portions of the Swan Range and Mission Mountains that were not surveyed in 2010. MPB activity continued in these areas, primarily in LPP and PP hosts. Activity was especially high near Seeley Lake, where approximately 3,000 acres of mortality was mapped, with mortality levels ranging from 15 to 45 TPA. Surveys in the southeastern portion of the county that were flown in 2010 within the Garnet Range continued to show low levels of MPB-caused mortality.

WSBW activity increased in the southeastern portion of the county where only sporadic DF defoliation occurred in 2010. Widespread low and moderate (less than 50 percent crown defoliation) levels of damage were noted in this area. Small areas of DFTM were also noted, primarily in landscape trees.

During the 2011 ADS, 35 acres of larch needle blight were mapped in the very southern portion of the Flathead IR. Almost 3,000 acres of larch needle cast were mapped, nearly evenly split between national forest and private lands. Most is located in the Seeley-Swan corridor, in areas east of Missoula, and in the northwest portion of the county, along the Ninemile Divide. One 58-acre patch of wind throw was mapped on tribal lands just east of Arlee, and one 125-acre patch of Diplodia tip blight was mapped just southwest of Arlee.

White pine blister rust is common in both WWP and WBP. Root diseases are common in counties west of the Continental Divide. The more common ones known to occur in this county are s-type annosus root disease, armillaria root disease, laminated root disease, and schweinitzii root and butt rot. The tree species most affected are DF and true firs. P-type annosus root disease is known to occur in PP. Armillaria root disease was noted in PP and DF in the Rattlesnake Recreation Area (MFO-TR-11-21), and was notable in PP east of Salmon Lake (MFO-TR-11-30). Elytroderma needle disease is a significant agent in PP in localized areas in this county. Comandra blister rust is common in PP in this county and was noted in the Rattlesnake Recreation Area (MFO-TR-11-21). Douglas-fir dwarf mistletoe, lodgepole pine dwarf mistletoe, and western larch dwarf mistletoe are present in this county.

## Musselshell County

### Forestland, Mortality, and Defoliation Acres by Ownership (667,346 acres surveyed)

	National Forest	Other Federal	Private	State	Total
<b>Forestland</b>	0	21,633	272,609	13,984	308,225
<b>MPB-PP</b>	0	20	276	2	298

In 2011, 667,345 acres (or about two-thirds) of Musselshell County were included in the survey of the Bull Mountains. Despite the large area surveyed, only approximately 300 acres of PP mortality caused by MPB was noted. Most MPB activity occurred on private lands, with traces on BLM and State lands. No survey of this area was conducted in 2010.

## Park County

### Forestland, Mortality, and Defoliation Acres by Ownership (788,031 acres surveyed)

	National Forest	Other Federal	Private	State	Total
<b>Forestland</b>	736,421	70,512	178,181	32,732	1,017,846
<b>Dieback</b>	11	0	2	0	13
<b>DFB</b>	317	25	143	2	487
<b>MPB-LPP</b>	3,909	10,036	1,767	4	15,716
<b>MPB-High Elevation</b>	3,115	1,002	1,082	5	5,204
<b>SAF</b>	541	63	46	0	650
<b>WSBW</b>	6,474	5,774	29,726	1,140	43,114

Within Park County, similar areas were surveyed in 2011 and 2010. MPB activity declined significantly within the county in 2011. Number of acres defoliated by WSBW increased substantially, nearly doubling from 2010 levels and WSBW activity was noted in 2011 in areas where no prior defoliation was detected. Defoliation was typically at high levels (greater than 50 percent crown defoliation) in DF host. DFB activity was noted in ground surveys in multiple, moderate sized pockets (up to 30 trees per group) within the Main Boulder Canyon of the Beartooth Mountains and Mill Creek drainage in the Absaroka Range (MFO-TR-11-36). DFB activity primarily occurred in trees with high levels of prior WSBW defoliation.

White pine blister rust is common in WBP and LP. Tomentosus root disease is known to be significant in some campgrounds in this county. Lodgepole pine dwarf mistletoe is also present.

## Petroleum County

### Forestland, Mortality, and Defoliation Acres by Ownership (273,862 acres surveyed)

	National Forest	Other Federal	Private	State	Total
<b>Forestland</b>	0	78,668	26,784	11,587	117,039
<b>Flooding</b>	0	0	0	5	5
<b>MPB-PP</b>	0	110	56	10	176

In 2011, the northern third of Petroleum County was flown as part of a survey of the larger Fort Peck area. No survey of this area was conducted in 2010, nor has an aerial survey for forest

insect activity been done in this area previously. MPB in PP was noted as a damage agent on approximately 176 acres of BLM, FWP, and State lands, as well as private land. Flooding damage, although sometimes hard to detect in aerial survey, is suspected on approximately 5 acres of State lands in the very northern portion of the county, just west of Hay Coulee, near Carls Camp Road.

## Phillips County

### Forestland, Mortality, and Defoliation Acres by Ownership (237,520 acres surveyed)

	National Forest	Other Federal	Private	State	Total
<b>Forestland</b>	0	95,821	49,563	0	145,384
<b>Dieback</b>	0	58	9	0	67
<b>DFB</b>	0	4	2	0	6
<b>Flooding</b>	0	30	0	0	30
<b>MPB-LPP</b>	0	19	2	0	21
<b>MPB-PP</b>	0	222	64	20	306

In 2011, a small portion of Phillips County, along its southern border with Garfield and Petroleum Counties, was flown as part of a survey of the larger Fort Peck area. No survey of the Fort Peck area was conducted in 2010, nor has an aerial survey for insect activity been done in this area previously. MPB in PP was the principle damage agent, as in other portions of the Fort Peck survey.

Another small portion of Phillips County in the Little Rocky Mountains (Fort Belknap IR, BLM, and some private lands) was surveyed in 2011; most of this area had also been surveyed in 2010. MPB activity in both LPP and PP was noted, as well as DFB in DF and dieback in aspen.

Two areas of flood damage (30 acres), mostly on BLM lands, were mapped in the very southeast corner of the county. One area is located northeast of the Swede Ridge Road, and the other area is northeast of Schuyler Butte, just south of the State land section.

Lodgepole pine dwarf mistletoe is present in this county.

## Pondera County

### Forestland, Mortality, and Defoliation Acres by Ownership (125,399 acres surveyed)

	National Forest	Other Federal	Private	State	Total
<b>Forestland</b>	92,477	0	8,602	0	101,079
<b>DFB</b>	76	0	0	0	76
<b>FE</b>	24	0	0	0	24
<b>MPB-LPP</b>	2,093	12	19	335	2,459
<b>MPB-High Elevation</b>	0	2	2	0	4
<b>SAF</b>	727	0	0	0	727
<b>WSBW</b>	62	1	812	45	920

In 2011 aerial surveys occurred in the western portion of Pondera County in the Rocky Mountain Front. In this area, MPB activity declined approximately two-fold in acres mapped but

continued to cause LPP mortality. In the eastern portion of the county, SAF mortality continued in 2011, but decreased substantially from 2009 and 2010 levels.

White pine blister rust is common in WBP and LP.

## Powder River

### Forestland, Mortality, and Defoliation Acres by Ownership (400,046 acres surveyed)

	National Forest	Other Federal	Private	State	Total
<b>Forestland</b>	252,617	70,910	166,629	15,138	505,294
<b>Avalanche</b>	2	0	0	0	2
<b>MPB-PP</b>	299	0	51	0	350
<b>IPS</b>	2	0	0	0	2
<b>DF Tussock Moth</b>	45	0	12	0	57
<b>Wind throw</b>	292	0	4	0	296

In 2011, areas on the Custer National Forest were surveyed, covering about one-quarter of Powder River County; no survey of these areas was conducted in 2010. Approximately 350 acres of PP mortality due to MPB activity was mapped. Also noted on PP were approximately 57 acres of DFTM caused defoliation and 2 acres of IPS caused mortality of smaller diameter trees. Damage was principally on the national forest, although private lands were also affected. Two acres of avalanche damage were mapped in the northwest corner of the county on national forest near Daily Creek Spring, above East Fork Beaver Creek Divide Road. Also mapped during 2011 ADS was one large area (296 acres) of wind throw, mostly on national forest just east of Otter and south of the Tooley Creek Road (State Road 484).

## Powell County

### Forestland, Mortality, and Defoliation Acres by Ownership (692,119 acres surveyed)

	National Forest	Other Federal	Private	State	Total
<b>Forestland</b>	617,273	70,663	251,596	29,711	969,244
<b>DFB</b>	202	751	100	8	1,061
<b>FE</b>	0	0	0	2	2
<b>Larch Needle Cast</b>	0	0	1	0	1
<b>MPB-LPP</b>	72,355	33,809	15,986	2,814	124,963
<b>MPB-PP</b>	313	4,381	13,824	1,494	20,012
<b>MPB-High Elevation</b>	167	0	0	0	167
<b>SAF</b>	18	2	0	0	20
<b>WPB</b>	0	0	2	2	4
<b>WSBW</b>	34,609	26,009	45,253	6,143	112,014

Almost twice as many acres in Powell County were aerially surveyed in 2011 as in 2010. MPB activity continued across the county. The intensity of the outbreak appears to have decreased in the southeast portion of the county, but remained at similar levels in the central portion of the county. The intensity (TPA killed by MPB) decreased in PP.

WSBW significantly increased in the number of acres defoliated and the intensity of defoliation in areas flown in 2011. DFB increased between 2010 and 2011, possibly responding to trees that were weakened by heavy defoliation from WSBW.

Root diseases are common in counties west of the Continental Divide. The more common ones known to occur in this county are s-type annosus root disease, armillaria root disease, and schweinitzii root and butt rot. The tree species most affected are DF and true firs. P-type annosus root disease is known to occur in PP. Armillaria root disease was notable in PP east of Salmon Lake (MFO-TR-11-30). Significant schweinitzii root and butt rot has been responsible for DF tree failure at the Monture Campground. Armillaria root disease has been significant in DF and SAF in the Big Nelson Campground. Stem decay has been noteworthy in Monture Campground, including Indian Paint fungus in SAF, red belt fungus in spruce, and red ring rot in western larch.

White pine blister rust is common in WBP and LP. Lodgepole pine dwarf mistletoe is present in this county.

## Ravalli County

### Forestland, Mortality, and Defoliation Acres by Ownership (856,292 acres surveyed)

	National Forest	Other Federal	Private	State	Total
<b>Forestland</b>	1,063,159	0	136,936	25,844	1,225,939
<b>DFB</b>	66	0	83	2	151
<b>MPB-LPP</b>	78,373	0	1,195	187	79,755
<b>MPB-PP</b>	20,252	0	1,267	218	21,737
<b>MPB-High Elevation</b>	118	0	0	0	118
<b>Pine Butterfly</b>	737	0	47	0	784
<b>SAF</b>	46	0	0	0	46
<b>WSBW</b>	4,582	0	688	265	5,535

In 2011, the area surveyed in Ravalli County was approximately 25 percent less than the area surveyed in 2010. Since much of the area was flown during wildfire season when smoke levels were high and visibility was low, surveyors indicated that mortality levels are likely underestimated in 2011. Even so, MPB activity increased substantially in 2011, especially in LPP and PP host types.

Mortality levels were greatest in the southern portion of the county in LPP, where groups of 10 to 30 TPA were widespread. In the central and northern portions of the county, MPB activity increased in PP especially in areas near Lake Como, where ground surveys found groups of up to 150 trees killed by MPB (MFO-TR-11-18). Scattered groups of mortality were also noted throughout PP in northern portions of the county (MFO-TR-11-11). MPB activity appeared to decline in 2011 based on surveys; however, this may be due to the reduced survey area in 2011. DFB activity increased in isolated areas, such as near the Laird Creek drainage in the Bitterroot Mountains (MFO-TR-11-12).

WSBW activity increased, causing defoliation in new locations throughout the county. Defoliation was widespread at low to moderate levels (less than 50 percent crown defoliation) and was greatest in the Sapphire Mountains, where DF host type is high. Pine butterfly activity also increased throughout the county in PP. Despite high populations of caterpillars, defoliation

primarily occurred at low levels (less than 15 percent crown defoliation). Some locations, such as just north of Skalkaho Pass, had extensive levels (up to 80 percent crown defoliation) of pine butterfly defoliation across 600 acres.

BWA was detected on SAF or GF through ground surveys in this county for the first time in 2010. BWA was detected in multiple locations east of Stevensville, along Ambrose Saddle Road, as well as west of Darby, near Lake Como.

White pine blister rust is common in WBP. Root diseases are common in counties west of the Continental Divide. The more common ones known to occur in this county are s-type annosus root disease, armillaria root disease, laminated root disease, and schweinitzii root and butt rot. The tree species most affected are DF and true firs. P-type annosus root disease is known to occur in PP in the foothills of both the Bitterroot and Sapphire Mountains, and was noted in a stand in Lick Creek (MFO-TR-11-18).

Elytroderma needle disease is a significant agent in PP in localized areas in this county and was noted at the Trapper Creek Job Corps Center (MFO-TR-11-05). High levels continue to exist in the area around Lake Como. Notable levels of comandra blister rust causing top kill in PP were noted in the foothills of the Bitterroot Mountains (MFO-TR-11-18).

Douglas-fir dwarf mistletoe, lodgepole pine dwarf mistletoe, and western larch dwarf mistletoe are present in this county, with Douglas-fir dwarf mistletoe being quite common in the lower elevations of the Sapphire and Bitterroot Mountains (MFO-TR-11-18).

## Rosebud County

### Forestland, Mortality, and Defoliation Acres by Ownership (408,086 acres surveyed)

	National Forest	Other Federal	Private	State	Total
Forestland	84,806	38,441	213,878	38,814	375,939
MPB-PP	42	70	15	0	127

In Rosebud County, 408,085 acres in two different areas were surveyed in 2011: a small portion in the northwest in the Bull Mountains and a large area in the south in the Northern Cheyenne IR and Custer NF. Within these areas, only small pockets of MPB-killed PP were noted.

## Sanders County

### Forestland, Mortality, and Defoliation Acres by Ownership (1,391,464 acres surveyed)

	National Forest	Other Federal	Private	State	Total
<b>Forestland</b>	899,309	9,005	447,326	62,199	1,417,838
<b>DFB</b>	424	2	90	15	531
<b>ESB</b>	2	0	0	0	2
<b>FE</b>	4	0	0	0	4
<b>Flooding</b>	62	2	0	0	64
<b>Larch Needle Blight</b>	6	331	0	56	393
<b>Larch Needle Cast</b>	3,556	0	772	37	4,375
<b>MPB-LPP</b>	11,217	313	752	525	12,808
<b>MPB-PP</b>	841	722	227	101	1,891
<b>MPB-WP</b>	0	2	0	0	2
<b>MPB-High Elevation</b>	26	0	32	0	58
<b>IPS</b>	3	18	6	2	29
<b>SAF</b>	80	14	10	2	106
<b>WPB</b>	2	6	0	0	8
<b>WSBW</b>	84,382	0	13,641	2,714	100,738

In 2011, the area surveyed within Sanders county increased compared to the 2010 survey. MPB activity was recorded at similar levels in 2010 and 2011, despite significantly more acres being flown in 2011. MPB activity decreased in both the southern portion of the Salish Mountains and on the southern portion of the Flathead IR. Mortality was primarily detected in LPP, but also in scattered pockets of PP.

WSBW defoliation of DF host significantly increased and was widespread throughout the central portions of the county in the Salish and Cabinet Mountains. WSBW caused damage was typically estimated as high severity (greater than 50 percent crown defoliation) within these affected areas. Also, DFB has infested a significant amount of wind throw that was created during a wind event in the Pilgrim Creek drainage.

BWA was detected on SAF or GF through ground surveys in this county for the first time in 2010. BWA was detected in multiple locations south of Plains, in the Combest Creek drainage, along National Forest Roads 7698 and 1508. BWA was also noted in multiple locations east of Talc, within the Graves Creek drainage.

Over 4,000 acres of larch needle cast were mapped during the 2011 ADS. Most of the damage was in the northwest corner of the county along the border with Idaho, in the center of the county, and along the border with Mineral County. Almost 400 acres of larch needle blight were also mapped in 2011, mostly on tribal lands (331 acres), but also on State lands (56 acres), just west of Hot Springs. One 64-acre area of flood damage was mapped, mostly on national forest (62 acres), along the Little Thompson River, just on the other side of the ridge west of Lonepine.

Root diseases are common in counties west of the Continental Divide. The more common ones known to occur in this county are s-type annosus root disease, armillaria root disease, laminated root disease, and schweinitzii root and butt rot. The tree species most affected are DF and true firs. P-type annosus root disease is known to occur in PP. Tomentosus root disease is known to occur in localized areas in the county, affecting LPP, DF and spruce. Armillaria root disease and laminated root disease were found to be significant agents of decline in the Pilgrim

Creek drainage on the west side of Noxon Reservoir (MFO-TR-11-02). Blow down was also associated with the root disease in Pilgrim Creek.

Western larch dwarf mistletoe, armillaria root disease, and tomentosus root disease continue to contribute to the decline of western larch along Montana State Highway 135, between St. Regis and Paradise.

White pine blister rust is common in both WWP and WBP. Elytroderma needle disease is a significant agent in PP in localized areas in this county. Rhabdocline needle cast was found to be a significant agent in DF in the Plains Tree Improvement Area (MFO-TR-11-31). Douglas-fir dwarf mistletoe, lodgepole pine dwarf mistletoe, and western larch dwarf mistletoe are present and common in this county.

## Silver Bow County

### Forestland, Mortality, and Defoliation Acres by Ownership (76,153 acres surveyed)

	National Forest	Other Federal	Private	State	Total
<b>Forestland</b>	181,514	20,857	50,180	3,486	256,038
<b>DFB</b>	0	0	4	0	4
<b>MPB-LPP</b>	94	0	34	0	128
<b>Unidentified Defoliator</b>	28	0	57	0	85
<b>WSBW</b>	12	0	85	0	97

In 2011, only a small area in the northern portion of Silver Bow County was surveyed. MPB activity continued at low rates within LPP host type within the areas surveyed. It is expected that MPB activity is declining in areas that previously had high rates of mortality within the county. WSBW activity was detected in the northern portion of the county in isolated locations. Defoliation of DF was recorded at low levels (less than 50 percent crown defoliation).

White pine blister rust is common in WBP and LP.

## Stillwater County

### Forestland, Mortality, and Defoliation Acres by Ownership (111,782 acres surveyed)

	National Forest	Other Federal	Private	State	Total
<b>Forestland</b>	115,980	0	108,625	7,940	232,545
<b>DFB</b>	9	0	7	0	16
<b>MPB-LPP</b>	14	0	2	0	16
<b>MPB-High Elevation</b>	2	0	0	0	2
<b>WSBW</b>	2,452	463	3,941	513	7,369
<b>Wind throw</b>	64	0	0	0	64

In 2011, forested lands in Stillwater County, along the northeast edge of the Beartooth Mountains and outside of the Absaroka-Beartooth Wilderness were surveyed. No survey of this county was conducted in 2010. The insect of greatest concern was WSBW, with almost 7,400 acres of defoliation detected: almost 4,000 acres on private lands; almost 2,500 acres on

national forest; and approximately 500 acres on each of BLM and State lands. Only 16 and 18 acres of DFB and MPB were detected, respectively.

One 64-acre area of wind throw was mapped during 2011 ADS on national forest near West Rosebud Creek, northeast of Reeves Ranch.

## Sweet Grass County

### Forestland, Mortality, and Defoliation Acres by Ownership (208,551 acres surveyed)

	National Forest	Other Federal	Private	State	Total
<b>Forestland</b>	246,540	13,228	146,449	0	406,217
<b>DFB</b>	115	0	12	0	127
<b>MPB-LPP</b>	761	11	26	0	798
<b>MPB-High Elevation</b>	939	0	0	0	939
<b>SAF</b>	97	0	1	0	98
<b>WSBW</b>	5,761	0	10,262	23	16,076

MPB activity declined in 2011 throughout surveyed areas in Sweet Grass County and continued at low levels in LPP and 5-needed pine hosts. Mortality was primarily detected in the Absaroka Range and Crazy Mountains. WSBW defoliation was detected throughout the county in DF at severe levels (greater than 50 percent crown defoliation). Ground surveys indicated high levels of cumulative WSBW-caused defoliation and increasing DFB activity within the Big Timber Canyon in the Crazy Mountains. DFB activity primarily occurred in trees with high levels of prior WSBW defoliation (MFO-TR-11-36).

White pine blister rust has been found in WBP and LP.

## Teton County

### Forestland, Mortality, and Defoliation Acres by Ownership (254,904 acres surveyed)

	National Forest	Other Federal	Private	State	Total
<b>Forestland</b>	215,601	9,427	17,446	9,427	251,900
<b>Dieback</b>	13	0	143	1	157
<b>DFB</b>	840	165	66	15	1,086
<b>MPB-LPP</b>	5,296	248	552	585	6,681
<b>MPB-PP</b>	0	0	2	0	2
<b>MPB-High Elevation</b>	33	0	48	18	99
<b>SAF</b>	444	2	0	0	446
<b>WSBW</b>	247	190	1,006	796	2,239

Significantly fewer acres were surveyed within Teton County in 2011, as wilderness areas flown in 2010 were not revisited. MPB activity appeared to decrease in areas that were flown during both years. Limited activity was detected in LPP. Subalpine fir mortality also continued in surveyed areas.

Root disease was tentatively identified in aspen and DF in Cave Creek Campground, but needs further investigation (MFO-TR-11-32).

White pine blister rust is common in WBP and LP in this county.

## Toole County

Aerial detection surveys were not conducted in Toole County during 2011. White pine blister rust occurs in WBP and LP in this county.

## Treasure County

The 2011 survey of the Bull Mountains included a sliver of Treasure County (1,497 acres surveyed). Due to the very small area surveyed, only 2 acres (1 tree) of MPB-killed ponderosa pine was noted.

## Valley County

### Forestland, Mortality, and Defoliation Acres by Ownership (287,935 acres surveyed)

	National Forest	Other Federal	Private	State	Total
Forestland	0	25,644	13,843	0	39,487
MPB-PP	0	34	0	10	44
Unidentified defoliat.	0	0	2	0	2

In 2011, a small portion of Valley County along the border with Garfield County was flown as part of a survey of the larger Fort Peck area. No survey of this area was conducted in 2010 nor has an aerial survey for forest insect activity been done in this area previously. As with other portions of the Fort Peck survey, MPB in PP was noted on BLM, FWP, and State lands (44 acres total). An unidentified defoliator was also noted as damaging trees on approximately 2 acres of private lands.

## Wheatland County

### Forestland, Mortality, and Defoliation Acres by Ownership (60,693 acres surveyed)

	National Forest	Other Federal	Private	State	Total
Forestland	53,771	0	22,404	0	76,175
DFB	2	0	0	0	2
MPB-LPP	2,962	0	12	0	2,974
MPB-PP	4,366	85	310	0	4,761
MPB-High Elevation	6	0	2	0	8
WSBW	12,512	152	2,727	136	15,527

Significantly more area in Wheatland County was aerially surveyed in 2011 relative to 2010, although only small portions of the county were flown in both years. MPB activity increased in the northern portion of the county in the Little Belt Mountains and decreased in the southwestern portion of the county in the Crazy Mountains. MPB-caused mortality substantially increased in PP relative to 2010; however, this may be due to the additional areas surveyed. WSBW continued to cause low levels of damage (less than 50 percent crown defoliation) in the

portions of the Little Belt Mountains surveyed and severe damage (greater than 50 percent crown defoliation) in the portions of the Crazy Mountains surveyed.

White pine blister rust occurs in LP in this county.

## **Yellowstone County**

### **Forestland, Mortality, and Defoliation Acres by Ownership (309,502 acres surveyed)**

	<b>National Forest</b>	<b>Other Federal</b>	<b>Private</b>	<b>State</b>	<b>Total</b>
<b>Forestland</b>	0	24,728	164,103	0	188,831
<b>MPB-PP</b>	0	14	56	4	74

Approximately 20 percent of Yellowstone County in an area within the Bull Mountains was surveyed in 2011; no survey was conducted of this area in 2010. Less than 75 acres of MPB-killed PP was noted, principally on private lands, with traces on BLM and State lands. One gypsy moth was detected in a baited pheromone trap in Billings.

**Table 1. Forest Mortality, Defoliation, and Other Damage on Montana National Forests, National Parks, and Tribal Lands, 2011**

<b><u>BEAVERHEAD NF</u></b>			<b>Acres</b>	<b>Trees</b>
<b>DILLON RD</b>	<b>Acres</b>	<b>Trees</b>		
Douglas-fir Beetle	4	2	Subalpine Fir Mortality	18 12
Mountain Pine Beetle (LPP)	17,648	28,127	MPB (High Elev 5-needle Pines)	4 10
Subalpine Fir Mortality	542	826	Western Spruce Budworm	1,863 0
MPB (High Elev 5-needle Pines)	8,936	11,594	Pine Butterfly	784 0
Western Spruce Budworm	8,312	na	<b>STEVENVILLE RD</b>	
<b>MADISON RD</b>			Douglas-fir Beetle	2 3
Douglas-fir Beetle	43	72	Mountain Pine Beetle (PP)	429 357
Engelmann Spruce Beetle	2,167	909	Mountain Pine Beetle (LPP)	1,507 2,197
Mountain Pine Beetle (PP)	35	29	Subalpine Fir Mortality	4 9
Mountain Pine Beetle (LPP)	34,323	55,314	Western Spruce Budworm	876 0
Subalpine Fir Mortality	4,837	2,945	<b>SULA RD</b>	
MPB (High Elev 5-needle Pines)	4,305	2,725	Douglas-fir Beetle	20 53
Western Spruce Budworm	21,996	na	Mountain Pine Beetle (PP)	1,801 2,479
Windthrow	24	24	Mountain Pine Beetle (LPP)	17,678 75,051
<b>SHERIDAN RD</b>			Subalpine Fir Mortality	22 45
Douglas-fir Beetle	175	37	MPB (High Elev 5-needle Pines)	16 35
Engelmann Spruce Beetle	873	179	Western Spruce Budworm	1,988 0
Mountain Pine Beetle (PP)	6	4	<b>WEST FORK RD</b>	
Mountain Pine Beetle (LPP)	27,935	26,982	Douglas-fir Beetle	22 77
Subalpine Fir Mortality	12,725	8,038	Mountain Pine Beetle (PP)	13,879 18,075
MPB (High Elev 5-needle Pines)	18,096	17,021	Mountain Pine Beetle (LPP)	51,732 303,578
Western Spruce Budworm	7,123	na	Subalpine Fir Mortality	2 1
Avalanche	34	34	MPB (High Elev 5-needle Pines)	98 43
Dieback	2	na	Western Spruce Budworm	149 0
<b>WISDOM RD</b>			<b>CUSTER NF</b>	
Mountain Pine Beetle (LPP)	809	2,794	<b>ASHLAND RD</b>	
<b>WISE RIVER RD</b>			Pine Engraver Beetle (PP)	2 3
Mountain Pine Beetle (LPP)	3,575	7,260	Mountain Pine Beetle (PP)	387 293
MPB (High Elev 5-needle Pines)	93	652	Pine Tussock Moth	57 0
Western Spruce Budworm	236	na	Windthrow	295 296
<b>BITTERROOT NF</b>			Avalanche	2 3
<b>DARBY RD</b>			Unknown	2 10
Douglas-fir Beetle	22	40	<b>BEARTOOTH RD</b>	
Mountain Pine Beetle (PP)	5,037	5,688	Douglas-fir Beetle	78 344
Mountain Pine Beetle (LPP)	9,074	29,356	Engelmann Spruce Beetle	8 55
			Mountain Pine Beetle (LPP)	2,437 3,128

	Acres	Trees		Acres	Trees
Subalpine Fir Mortality	368	230	MPB (High Elev 5-needle Pines)	26	40
MPB (High Elev 5-needle Pines)	2,213	3,601	Western Spruce Budworm	62,156	0
Western Spruce Budworm	3,598	0	Larch Needle Blight	894	0
Windthrow	97	1,902	Larch Needle Cast	9,605	0
<b>SIOUX RD</b>	<b>Acres</b>	<b>Trees</b>	Avalanche	22	100
Mountain Pine Beetle (PP)	225	152	Dieback	8	0
Windthrow	22	20	<b>HUNGRY HORSE RD</b>		
<b>DEERLODGE NF</b>			Douglas-fir Beetle	14	24
<b>BUTTE</b>			Mountain Pine Beetle (PP)	6	4
Mountain Pine Beetle (LPP)	202	911	Mountain Pine Beetle (LPP)	233	363
Western Spruce Budworm	56	0	Subalpine Fir Mortality	20	32
Unidentified Defoliator	84	0	Western Spruce Budworm	18,177	0
<b>DEER LODGE</b>			Larch Needle Cast	16	0
Douglas-fir Beetle	40	60	Avalanche	30	41
Mountain Pine Beetle (PP)	85	175	<b>SPOTTED BEAR RD</b>		
Mountain Pine Beetle (LPP)	16,781	68,845	Subalpine Fir Mortality	0	0
MPB (High Elev 5-needle Pines)	60	30	Larch Needle Cast	3	0
Western Spruce Budworm	1,398	0	<b>SWAN LAKE RD</b>		
<b>JEFFERSON</b>			Douglas-fir Beetle	588	759
Douglas-fir Beetle	4	8	Mountain Pine Beetle (WP)	77	40
Mountain Pine Beetle (LPP)	3,960	11,035	Mountain Pine Beetle (PP)	2,456	6,475
Subalpine Fir Mortality	2	5	Mountain Pine Beetle (LPP)	7,710	26,561
MPB (High Elev 5-needle Pines)	20	63	Fir Engraver Beetle	14	22
Western Spruce Budworm	5,553	0	Subalpine Fir Mortality	64	125
<b>PHILIPSBURG</b>			Western Spruce Budworm	49,629	0
Douglas-fir Beetle	91	170	Unidentified Defoliator	4	0
Mountain Pine Beetle (PP)	2,383	1,409	Larch Needle Blight	116	0
Mountain Pine Beetle (LPP)	64,690	200,673	Larch Needle Cast	4,340	0
Subalpine Fir Mortality	6	10	Flooding - High Water	2	10
MPB (High Elev 5-needle Pines)	66	57	Avalanche	10	9
Western Spruce Budworm	3,506	0	<b>TALLY LAKE RD</b>		
Unidentified Defoliator	111	0	Douglas-fir Beetle	74	82
<b>FLATHEAD NF</b>			Engelmann Spruce Beetle	2	1
<b>GLACIER VIEW RD</b>			Mountain Pine Beetle (PP)	14	21
Douglas-fir Beetle	34	52	Mountain Pine Beetle (LPP)	64	155
Engelmann Spruce Beetle	6	4	Fir Engraver Beetle	2	1
Mountain Pine Beetle (PP)	18	24	Subalpine Fir Mortality	135	171
Mountain Pine Beetle (LPP)	158	433	Western Spruce Budworm	21,852	0
Fir Engraver Beetle	32	69	Larch Needle Cast	6,951	0
Subalpine Fir Mortality	2,098	9,439			

### GALLATIN NF

#### **BIG TIMBER RD**

Douglas-fir Beetle	352	1,125
Mountain Pine Beetle (LPP)	389	1,106
Subalpine Fir Mortality	97	220
MPB (High Elev 5-needle Pines)	948	2,082
Western Spruce Budworm	10,271	0

#### **BOZEMAN RD**

	<b>Acres</b>	<b>Trees</b>
Douglas-fir Beetle	50	262
Mountain Pine Beetle (PP)	4	8
Mountain Pine Beetle (LPP)	24,930	87,850
Subalpine Fir Mortality	761	3,030
MPB (High Elev 5-needle Pines)	10,758	37,416
Western Spruce Budworm	14,882	0

#### **GARDINER RD**

Douglas-fir Beetle	28	137
Mountain Pine Beetle (LPP)	2,034	8,899
Subalpine Fir Mortality	562	2,576
MPB (High Elev 5-needle Pines)	1,690	5,532
Western Spruce Budworm	3,156	0
Dieback	13	0

#### **HEBGEN LAKE RD**

Douglas-fir Beetle	14	60
Mountain Pine Beetle (LPP)	8,536	32,264
Subalpine Fir Mortality	104	360
MPB (High Elev 5-needle Pines)	1,524	3,604
Western Spruce Budworm	4,606	0
Flooding - High Water	4	20
Dieback	38	0

#### **LIVINGSTON RD**

Douglas-fir Beetle	176	571
Mountain Pine Beetle (LPP)	3,317	11,307
Subalpine Fir Mortality	8	35
MPB (High Elev 5-needle Pines)	4,778	10,104
Western Spruce Budworm	8,189	0
Windthrow	549	38,837

### HELENA NF

#### **HELENA RD**

Douglas-fir Beetle	57	75
Engelmann Spruce Beetle	2	3

	<b>Acres</b>	<b>Trees</b>
Mountain Pine Beetle (PP)	8,311	35,465
Mountain Pine Beetle (LPP)	79,055	409,473
Subalpine Fir Mortality	4	10
MPB (High Elev 5-needle Pines)	10	93
Western Spruce Budworm	72,191	0

	<b>Acres</b>	<b>Trees</b>
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Douglas-fir Beetle	363	1,197
Pine Engraver Beetle (PP)	2	50
Mountain Pine Beetle (PP)	1,425	6,673
Mountain Pine Beetle (LPP)	92,558	727,833
Subalpine Fir Mortality	12	80
MPB (High Elev 5-needle Pines)	62	58
Western Spruce Budworm	109,264	0

#### **TOWNSEND RD**

Douglas-fir Beetle	6	8
Mountain Pine Beetle (PP)	2	5
Mountain Pine Beetle (LPP)	12,772	68,593
MPB (High Elev 5-needle Pines)	6	13
Western Spruce Budworm	4,739	0

### KOOTENAI NF

#### **CABINET RD**

Douglas-fir Beetle	301	382
Mountain Pine Beetle (PP)	70	77
Mountain Pine Beetle (LPP)	9,805	16,020
Fir Engraver Beetle	2	1
Subalpine Fir Mortality	24	24
MPB (High Elev 5-needle Pines)	58	67
Western Spruce Budworm	11,934	0
Larch Needle Cast	1,288	0

#### **FISHER RIVER RD**

Douglas-fir Beetle	30	46
Mountain Pine Beetle (PP)	576	158
Mountain Pine Beetle (LPP)	1,674	2,279
Subalpine Fir Mortality	4	2
Western Spruce Budworm	16,559	0
Larch Needle Cast	51	0

#### **FORTINE RD**

Douglas-fir Beetle	4	3
Mountain Pine Beetle (PP)	4	7

	Acres	Trees		Acres	Trees
Mountain Pine Beetle (LPP)	1,100	430	Western Spruce Budworm	80,711	0
Subalpine Fir Mortality	56	82	Windthrow	14	14
Western Spruce Budworm	3,681	0	Subalpine Fir Mortality MPB (High Elev 5-needle Pines)	286	261
Larch Needle Cast	227	0	Western Spruce Budworm	3,002	1,285
<b>LIBBY RD</b>	<b>Acres</b>	<b>Trees</b>	Windthrow	53,726	0
Douglas-fir Beetle	68	63		0	0
Mountain Pine Beetle (PP)	82	59	<b>MUSSELSHELL RD</b>		
Mountain Pine Beetle (LPP)	10	10	Douglas-fir Beetle	4	8
Fir Engraver Beetle	10	6	Mountain Pine Beetle (PP)	4,409	34,720
Subalpine Fir Mortality	32	47	Mountain Pine Beetle (LPP)	3,828	20,391
Western Spruce Budworm	22,534	0	Subalpine Fir Mortality MPB (High Elev 5-needle Pines)	2	10
Larch Needle Cast	667	0	Western Spruce Budworm	204	316
<b>REXFORD RD</b>			Windthrow	14,280	0
Douglas-fir Beetle	44	53		15	100
Mountain Pine Beetle (PP)	50	37	<b>ROCKY RD</b>		
Mountain Pine Beetle (LPP)	218	415	Douglas-fir Beetle	1,453	3,517
Subalpine Fir Mortality	115	167	Mountain Pine Beetle (PP)	301	887
Western Spruce Budworm	11,669	0	Mountain Pine Beetle (LPP)	11,871	76,547
Larch Needle Cast	1,582	0	Fir Engraver Beetle	26	42
<b>THREE RIVERS RD</b>			Subalpine Fir Mortality MPB (High Elev 5-needle Pines)	1,181	4,779
Douglas-fir Beetle	498	547	33	69	
Engelmann Spruce Beetle	2	1	Western Spruce Budworm	291	0
Mountain Pine Beetle (PP)	620	210	Dieback	13	0
Mountain Pine Beetle (LPP)	3,794	1,778	<b>LOLO NF</b>		
Fir Engraver Beetle	18	10	<b>MISSOULA RD</b>		
Subalpine Fir Mortality	412	487	Douglas-fir Beetle	42	48
MPB (High Elev 5-needle Pines)	6	6	Mountain Pine Beetle (PP)	822	2,929
Western Spruce Budworm	11,883	0	Mountain Pine Beetle (LPP)	5,836	29,334
Larch Needle Cast	3,670	0	Western Spruce Budworm	2,685	0
<b>LEWIS and CLARK NF</b>			Larch Needle Cast	163	0
<b>JUDITH RD</b>			<b>NINEMILE RD</b>		
Douglas-fir Beetle	155	596	Douglas-fir Beetle	105	147
Engelmann Spruce Beetle	4	7	Pine Engraver Beetle (PP)	2	7
Pine Engraver Beetle (PP)	2	20	Mountain Pine Beetle (PP)	5,770	2,498
Mountain Pine Beetle (PP)	6,514	23,151	Mountain Pine Beetle (LPP)	15,879	14,293
Mountain Pine Beetle (LPP)	31,737	98,749	Subalpine Fir Mortality	40	33
Subalpine Fir Mortality	1,942	4,020	Western Spruce Budworm	581	0
Pine Engraver Beetle (LPP)	23	30	Larch Needle Cast	2,330	0
MPB (High Elev 5-needle Pines)	8,736	21,697	Unknown	6	17

<b>PLAINS RD</b>	<b>Acres</b>	<b>Trees</b>	<b>Acres</b>	<b>Trees</b>
Douglas-fir Beetle	123	112		
Mountain Pine Beetle (PP)	675	452		
Mountain Pine Beetle (LPP)	3,577	3,050		
Fir Engraver Beetle	2	1		
Subalpine Fir Mortality	42	36		
Western Spruce Budworm	12,902	0		
Larch Needle Blight	8	0		
Larch Needle Cast	2,203	0		
Flooding - High Water	62	10		
<b>SEELEY LAKE RD</b>				
Douglas-fir Beetle	115	146		
Mountain Pine Beetle (PP)	779	1,943		
Mountain Pine Beetle (LPP)	29,938	273,820		
Subalpine Fir Mortality	74	171		
MPB (High Elev 5-needle Pines)	112	336		
Western Spruce Budworm	4,665	0		
Larch Needle Cast	1,130	0		
<b>SUPERIOR RD</b>				
Douglas-fir Beetle	224	179		
Engelmann Spruce Beetle	2	1		
Mountain Pine Beetle (PP)	2,029	800		
Mountain Pine Beetle (LPP)	4,562	5,213		
Fir Engraver Beetle	12	8		
Subalpine Fir Mortality	82	57		
Western Spruce Budworm	128	0		
Larch Needle Cast	10,152	0		
Unknown	8	4		
<b>THOMPSON RD</b>				
Douglas-fir Beetle	86	77		
Engelmann Spruce Beetle	2	2		
Pine Engraver Beetle (PP)	3	2		
Mountain Pine Beetle (PP)	160	122		
Mountain Pine Beetle (LPP)	900	1,332		
Western Pine Beetle	2	1		
Subalpine Fir Mortality	35	37		
Western Spruce Budworm	68,964	0		
Larch Needle Cast	1,659	0		
<b>BLACKFEET IR</b>				
Mountain Pine Beetle (LPP)	282	521		
Subalpine Fir Mortality	2	2		
<b>CROW IR</b>				
Douglas-fir Beetle	575	459		
Engelmann Spruce Beetle	2	1		
Mountain Pine Beetle (LPP)	2,086	1,840		
Mountain Pine Beetle (PP)	512	515		
MPB (High Elev 5-needle Pines)	26	31		
Subalpine Fir Mortality	1,601	721		
Unidentified Defoliator	383	0		
Windthrow	182	182		
<b>FLATHEAD IR</b>				
Avalanche	2	10		
Diplodia Canker	316	0		
Douglas-fir Beetle	108	117		
Fir Engraver Beetle	56	115		
Flooding - High Water	2	10		
Larch Needle Blight	497	0		
Larch Needle Cast	22	0		
Mountain Pine Beetle (LPP)	6,971	8,761		
Mountain Pine Beetle (PP)	1,442	1,316		
Mountain Pine Beetle (WP)	2	1		
MPB (High Elev 5-needle Pines)	6	6		
Pine Engraver Beetle (LPP)	17	47		
Pine Engraver Beetle (PP)	36	43		
Subalpine Fir Mortality	160	299		
Western Pine Beetle	6	3		
Western Spruce Budworm	1,820	0		
Windthrow	127	156		
<b>FORT BELKNAP IR</b>				
Dieback	280	0		
Douglas-fir Beetle	8	11		
Mountain Pine Beetle (LPP)	173	725		
Mountain Pine Beetle (PP)	503	1,082		
Western Spruce Budworm	87	0		
<b>NORTHERN CHEYENNE IR</b>				
Mountain Pine Beetle (PP)	113	79		

	Acres	Trees
<b><u>ROCKY BOY'S IR</u></b>		
Dieback	102	0
Douglas-fir Beetle	4	8
Mountain Pine Beetle (LPP)	900	4,129
Mountain Pine Beetle (PP)	898	3,577
Western Spruce Budworm	2,485	0
<b><u>GLACIER NP</u></b>		
Avalanche	58	58
Douglas-fir Beetle	518	244
Engelmann Spruce Beetle	10	5
Fir Engraver Beetle	2	1
Flooding - High Water	4	4
Larch Needle Blight	3,976	0
Mountain Pine Beetle (LPP)	5,779	8,023
Mountain Pine Beetle (PP)	4	3
MPB (High Elev 5-needle Pines)	2	2
Subalpine Fir Mortality	474	930
Western Spruce Budworm	69,877	0
<b><u>YELLOWSTONE NP</u></b>		
Douglas-fir Beetle	27	57
Mountain Pine Beetle (LPP)	15,284	60,956
MPB (High Elev 5-needle Pines)	1,190	2,409
Subalpine Fir Mortality	116	157
Western Spruce Budworm	4,554	0

**Source: 2011 Aerial Detection Surveys**

**Table 2. Host Type Infested by Bark Beetles on All Ownerships Statewide, 2011 (Acres)<sup>2</sup>**

Insect <sup>1</sup>	USFS	Other Fed	Private	State	Total
<b>DFB</b>	4,975	2,280	1,304	523	9,082
<b>ESB</b>	3,023	48	48	2	3,121
<b>FE</b>	110	33	62	6	211
<b>IPS</b>	31	41	37	6	115
<b>MPB-LPP</b>	618,124	96,985	81,037	20,194	816,340
<b>MPB-PP</b>	66,632	12,809	59,747	19,034	158,222
<b>MPB-High Elevation</b>	61,327	8,249	5,290	486	75,352
<b>MPB-WWP</b>	77	2	0	0	79
<b>MPB-ALL</b>	746,160	118,045	146,074	39,714	1,049,993
<b>SAF</b>	26,122	3,424	613	181	30,340
<b>WPB</b>	2	6	6	2	16

<sup>1</sup>DFB = Douglas-fir beetle; ESB = Spruce beetle; FE = Fir engraver beetle; IPS = Pine engraver beetle; MPB LPP = Mountain pine beetle in Lodgepole pine; MPB PP = Mountain Pine Beetle in Ponderosa pine; MPB 5-NP = Mountain pine beetle in 5-Needle pines (WBP & LP); MPB WP = Mountain pine beetle in Western white pine; MPB All = Mountain pine beetle in all pines; SAF = Subalpine fir mortality complex; WPB = Western pine beetle

<sup>2</sup>Includes areas surveyed in Yellowstone NP within WY

**Table 3. Bark Beetle Infestations Statewide, 2009 – 2011<sup>2,3</sup>**

Insects <sup>1</sup>	2009		2010		2011	
	Acres	Trees	Acres	Trees	Acres	Trees
<b>DFB</b>	22,528	52,873	16,052	31,219	9,082	15,307
<b>ESB</b>	72	100	5,827	44,390	3,121	1,186
<b>FE</b>	9,187	7,842	286	393	212	326
<b>MPB</b>	3,694,164	22,259,733	2,159,602	10,910,673	1,049,993	3,711,657
<b>IPS</b>	805	1,751	197	1,459	115	288
<b>SAF</b>	82,505	245,595	23,899	75,793	30,340	42,611
<b>WPB</b>	816	1,302	108	57	16	9
<b>Total</b>	3,810,077	22,569,196	2,205,971	11,063,984	1,092,878	3,771,384

<sup>1</sup>DFB = Douglas-fir beetle; ESB = Spruce beetle; FE = Fir engraver beetle; IPS = Pine engraver beetle; MPB = Mountain pine beetle; SAF = Subalpine fir mortality complex; WPB = Western pine beetle.

<sup>2</sup>Not all areas were flown due to fires, inclement weather or seasonal limitations

<sup>3</sup>Includes areas surveyed in Yellowstone NP within WY

**Table 4. Douglas-fir Beetle-Caused Mortality on All Ownerships Statewide, 2009 – 2011**

<b>Reporting Area</b>	<b>2009</b>			<b>2010</b>		
	<b>Acres</b>	<b>Trees</b>		<b>Acres</b>	<b>Trees</b>	<b>Acres</b>
Beaverhead	87	480		56*	280*	230*
Bitterroot	229	436		1,345	3,415	151*
Bull Mountains	★	★		★	★	0
Custer	2,941	7,552		★	★	154
Deerlodge	539	2,175		206*	402*	251*
Flathead	4,969	8,797		1,160*	1,506*	1,092*
Fort Peck Lake	★	★		★	★	2
Gallatin	2,446	10,302		5,313*	13,072*	672*
Garnets	122	236		36*	84*	757*
Helena	1,707	1,062		105*	103*	851*
Kootenai	466*	684*		373*	682*	953*
Lewis and Clark	3,382	14,418		5,091*	9,680*	1,908*
Lolo	1,626*	2,416*		129*	167*	771*
Blackfeet IR	582	61		213	605	★
Crow IR	125	96		★	★	575
Flathead IR	259	254		10*	16*	108
Fort Belknap IR	6*	6*		0	0	8*
No. Cheyenne IR	0	0		★	★	0
Rocky Boy's IR	24	60		2	15	4*
Glacier NP	2,939*	3,598*		362	344	518*
Yellowstone NP <sup>1</sup>	79	240		1,651	4,407	120*
<b>Total</b>	<b>22,528</b>	<b>52,873</b>		<b>16,052</b>	<b>34,778</b>	<b>9,123</b>
						<b>15,346</b>

★ = Not surveyed    \* = Partially surveyed

<sup>1</sup>Yellowstone NP includes acres in MT, ID, and WY

**Table 5. Mountain Pine Beetle-Caused Mortality on State and Private Lands, Statewide, 2009 – 2011(Acres)**

Reporting Area	2009				2010				2011			
	LPP	PP	5-NP	WWP	LPP	PP	5-NP	WWP	LPP	PP	5-NP	WWP
Beaverhead	31,580	0	4,095	0	14,912*	0*	970*	0*	5,579*	8*	1,191*	0*
Bitterroot	424	890	0	0	1,385	1,073	6	0	1,382*	1,495*	0*	0*
Bull Mountains	★	★	★	★	★	★	★	★	0	377	0	0
Custer	10	67	32	0	★	★	★	★	33	129	2	0
Deerlodge	97,179	2,602	2,289	0	43,923*	686*	7,988*	0*	15,687*	4,869*	430*	0*
Flathead	4,172	752	0	0	3,904*	498*	4*	0*	3,714*	1,110*	2*	0*
Fort Peck Lake	★	★	★	★	★	★	★	★	0	191	0	0
Gallatin	152,091	0	27,297	0	49,652*	4*	7,991*	0*	10,018*	4*	3,652*	0*
Garnets	35,560	28,315	0	0	25,546*	19,809*	0	0	18,922*	29,044*	0*	0*
Helena	136,546	178,360	2,836	0	62,367*	137,965*	2,336*	0*	25,120*	23,353*	1*	0*
Kootenai	1,894*	217*	0*	4*	1,938*	45*	0*	8*	1,598*	220*	32*	0*
Lewis and Clark	30,605	50,617	2,877	0	26,505*	29,185*	937*	0*	7,513*	11,307*	465*	0*
Lolo	31,478*	10,777*	0*	0*	9,785*	6,308*	177*	0*	10,607*	5,679*	0*	0*
Blackfeet IR	132	0	0	0	680	0	0	0	★	★	★	★
Crow IR	0	29	0	0	★	★	★	★	4	74	2	0
Flathead IR	987	662	0	0	41*	173*	0*	0*	631	243	0	0
Fort Belknap IR	10*	22*	0*	0*	61	697	0	0	35*	48*	0*	0*
No. Cheyenne IR	0	2	0	0	★	★	★	★	0	7	0	0
Rocky Boy's IR	1,507	132	0	0	1,505	2,225	0	0	179*	606*	0*	0*
Glacier NP	16*	0*	0*	0*	91	0	0	0	39*	2*	2*	0*
Yellowstone NP <sup>1</sup>	0	0	0	0	0	0	0	0	0*	0*	0*	0*
<b>Total</b>	<b>524,191</b>	<b>273,444</b>	<b>39,426</b>	<b>4</b>	<b>242,295</b>	<b>198,968</b>	<b>20,409</b>	<b>8</b>	<b>101,231</b>	<b>78,198</b>	<b>5,779</b>	<b>0</b>

<sup>1</sup>LPP = Lodgepole pine; PP = Ponderosa pine; 5-NP = 5-needle pines (WBP & LP); WWP = Western white pine

★ = Not surveyed; \* = Partially surveyed; <sup>1</sup>Yellowstone NP includes MT, ID, and WY acres

**Table 6. Mountain Pine Beetle-Caused Mortality on All Federal Ownerships, Statewide, 2009 – 2011(Acres)**

Reporting Area	2009				2010				2011			
	LPP	PP	5-NP	WWP	LPP	PP	5-NP	WWP	LPP	PP	5-NP	WWP
Beaverhead	265,158	0	116,697	0	235,848*	0*	54,069*	0*	91,811*	47*	32,498*	0*
Bitterroot	12,703	705	2,959	0	69,343	1,648	2,651	0	78,626*	20,262*	118*	0*
Bull Mountains	★	★	★	★	★	★	★	★	0	358	0	0
Custer	819	196	8,538	0	★	★	★	★	2,416	564	2,169	0
Deerlodge	539,967	2,935	19,120	0	220,921*	2,061*	18,829*	0*	83,703*	2,415*	146*	0*
Flathead	31,567	398	111	0	73,260*	854*	3,581*	2*	6,063*	1,674*	26*	77*
Fort Peck Lake	★	★	★	★	★	★	★	★	0	0	0	0
Gallatin	248,320	0	127,601	0	98,259*	0*	37,264*	0*	29,821*	2*	16,059*	0*
Garnets	53,578	2,057	0	0	47,093*	3,727*	0*	0*	36,600*	4,963*	0*	0*
Helena	459,157	104,332	12,471	0	295,815*	63,308*	11,578*	0*	181,007*	12,683*	77*	0*
Kootenai	45,284*	869*	10*	18*	11,911*	174*	4*	8*	15,003*	1,182*	32*	0*
Lewis and Clark	305,791	24,741	36,305	0	289,956*	17,286*	22,181*	0*	94,411*	24,589*	11,859*	0*
Lolo	294,013*	12,134*	50*	4*	55,567*	2,106*	0*	0*	54,163*	8,262*	112*	0*
Blackfeet IR	452	4	0	0	2,412	0	10	0	★	★	★	★
Crow IR	4	60	14	0	★	★	★	★	2,082	438	24	0
Flathead IR	15,946	2,044	160	0	1,739*	712*	0*	0*	6,339	1,200	6	2
Fort Belknap IR	226*	500*	0*	0*	679	449	4	0	138*	423*	0*	0*
No. Cheyenne IR	0	113	2	0	★	★	★	★	0	106	0	0
Rocky Boy's IR	4,231	437	0	0	3,775	502	0	0	722*	292*	0*	0*
Glacier NP	4,434*	2*	6*	0*	11,450	0	0	0	5,740*	2*	2*	0*
Yellowstone NP <sup>1</sup>	58,393	462	41,001	0	12,164	0	19,722	0	26,312*	0*	6,362*	0*
<b>Total</b>	<b>2,340,043</b>	<b>151,989</b>	<b>365,045</b>	<b>22</b>	<b>1,430,192</b>	<b>97,827</b>	<b>169,893</b>	<b>10</b>	<b>715,069</b>	<b>79,104</b>	<b>69,490</b>	<b>79</b>

<sup>1</sup> LPP = Lodgepole pine; PP = Ponderosa pine; 5-NP = 5-needle pines (WBP & LP); WWP = Western white pine

★ = Not surveyed; \* = Partially surveyed; <sup>1</sup>Yellowstone NP includes MT, ID, and WY acres

**Table 7. Additional Bark Beetle-Caused Mortality on All Ownerships, Statewide, 2009 – 2011(Acres)**

Reporting Area	Spruce Beetle			Fir Engraver			Pine Engraver			Subalpine Fir Mortality			Western Pine Beetle		
	2009	2010	2011	2009	2010	2011	2009	2010	2011	2009	2010	2011	2009	2010	2011
Beaverhead	6	5,785*	3,075*	0	0*	0*	0	0*	0*	554	3,582*	18,984*	0	0*	0*
Bitterroot	0	2	0*	18	0	0*	4	2	0*	5,589	2,126	46*	0	20	0*
Bull Mountains	★	★	0	★	★	0	★	★	0	★	★	0	★	★	0
Custer	0	★	8	0	★	0	0	★	2	771	★	368	0	★	0
Deerlodge	0	0*	0*	0	0*	0*	0	0*	0*	2,328	425*	10*	2	2*	0*
Flathead	32	22*	8*	494	163*	80*	2	0*	4*	13,038	7,410*	2399*	20	0*	0*
Fort Peck Lake	★	★	0	★	★	0	★	★	0	★	★	0	★	★	0
Gallatin	0	0*	0*	0	0*	0*	0	0*	0*	36,384	1,492*	1531*	0	0*	0*
Garnets	0	0*	0*	0	0*	4*	137	0*	2*	0	4*	2*	67	6*	0*
Helena	0	0	2*	0	0*	0*	0	64*	2*	20	39*	16*	2	0*	8*
Kootenai	8*	12*	2*	333*	40*	30*	6*	0*	0*	6,139*	2,257*	643*	128*	16*	0*
Lewis and Clark	0	0*	4*	0	0*	26*	0	42*	24*	4,173	4,054*	3413*	0	0*	0*
Lolo	2*	4*	4*	5,898*	73*	14*	616*	22*	5*	1,529*	165*	279*	575*	40*	2*
Blackfeet IR	2	0	★	801	0	★	0	0	★	107	235	★	0	0	★
Crow IR	0	★	0	0	★	0	0	★	0	4	★	1601	0	★	0
Flathead IR	0	0*	0	11	4*	56	40	67*	0	2,017	10	160	20	24*	6
Fort Belknap IR	0*	0	0*	0*	0	0*	0*	0	0*	0*	0	0*	0*	0	0*
No. Cheyenne IR	0	★	0	0	★	0	0	★	0	0	★	0	0	★	0
Rocky Boy's IR	0	0	0*	0	0	0*	0	0	0*	0	0	0*	2	0	0*
Glacier NP	4*	2	10*	1,632*	6	2*	0*	0	0*	7,509*	2,038	474*	0*	0	0*
Yellowstone NP <sup>1</sup>	18	0	8*	0	0	0*	0	0	0*	2,343	62	466*	0	0	0*
<b>Total</b>	<b>72</b>	<b>5,827</b>	<b>3,121</b>	<b>9,187</b>	<b>286</b>	<b>212</b>	<b>805</b>	<b>197</b>	<b>39</b>	<b>82,505</b>	<b>23,899</b>	<b>30,394</b>	<b>816</b>	<b>108</b>	<b>16</b>

★ = Not surveyed    \* = Partially surveyed

<sup>1</sup>Yellowstone NP includes MT, ID, and WY acres

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## COMMON AND SCIENTIFIC NAMES

Common Name	Pathogens	Primary Hosts
Annosus root disease	<i>Heterobasidion annosum</i> (Fr.:Fr.) Bref.	DF, GF, PP, SAF
Armillaria root disease	<i>Armillaria ostoyae</i> (Romagn.) Herink	DF, GF, SAF, saplings of all conifers
Black stain root disease	<i>Ophiostoma wageneri</i> (Goheen & F.W. Cobb ) Harrington	DF, PP
Comandra rust	<i>Cronartium comandrae</i> Pk.	LPP, PP
Cytospora canker	<i>Cytospora abietis</i> Sacc.	DF, GF, SAF
Diplodia shoot blight	<i>Diplodia pinea</i> (Desmaz.) J. Kickx fil.	PP
Dutch Elm Disease	<i>Ceratocystis ulmi</i> (Buisman) C. Moreau	Elms
Dwarf mistletoes	<i>Arceuthobium</i> spp.	DF, LP, LPP, WL
Elytroderma needle cast	<i>Elytroderma deformans</i> (Weir) Darker	PP
Fir broom rust	<i>Melampsorella caryophyllacearum</i> Schrock.	GF, SAF
Indian paint fungus	<i>Echinodontium tinctorium</i> (Ell. & Ev.) Ell. & Ev.	GF, WH
Laminated root rot	<i>Phellinus weiri</i> (Murrill) R.L. Gilbertson.	DF, GF, SAF, WH
Larch needle blight	<i>Hypodermella laricis</i> Tub.	WL
Larch needle cast	<i>Meria laricis</i> Vuill.	WL
Lodgepole pine needle cast	<i>Lophodermella concolor</i> (Dearn.) Darker	LPP
Red belt fungus	<i>Fomitopsis pinicola</i> (Schwartz :Fr.) Cooke	Conifers
Red ring rot	<i>Phellinus pini</i> (Thore :Fr.) A.Ames	DF, ES, PP, WL
Schweinitzii root and butt rot	<i>Phaeolus schweinitzii</i> (Fr. :Fr.) Pat.	Mainly DF, all conifers
Spruce broom rust	<i>Chrysomyxa arctostaphyli</i> Diet.	ES
Tomentosus root disease	<i>Inonotus tomentosus</i> (Fr.) Teng.	ES, DF, LPP, WL
White pine blister rust	<i>Cronartium ribicola</i> J.C. Fisch.	LP, WBP, WWP
Common Name	Insects	Primary Hosts
Balsam woolly adelgid	<i>Adelges piceae</i> Ratzeburg	GF, SAF
Douglas-fir beetle	<i>Dendroctonus pseudotsugae</i> Hopkins	DF
Douglas-fir tussock moth	<i>Orygia pseudotsugata</i> (McDunnough)	DF, ES, TF
Fir engraver beetle	<i>Scolytis ventralis</i> LeConte	GF, SAF
Gypsy moth	<i>Lymantria dispar</i> (Linnaeus)	Most hardwoods
Larch casebearer	<i>Coleophora laricella</i> (Hubner)	WL
Mountain pine beetle	<i>Dendroctonus ponderosae</i> Hopkins	All pines
Pine butterfly	Pine butterfly, <i>Neophasia menapia</i> (Felder & Felder)	PP
Pine engraver beetle	<i>Ips pini</i> (Say)	LPP, PP
Spruce beetle	<i>Dendroctonus rufipennis</i> Swaine	ES
Western balsam bark beetle	<i>Dryocoetes confuses</i> Swaine	SAF
Western pine beetle	<i>Dendroctonus brevicomis</i> LeConte	PP
Western pine (Grizzled) tussock moth	<i>Dasychira pinicola</i> (Dyar)	PP (DF,ES,GF,LPP, SAF, WL)

DF = Douglas-fir; GF = Grand fir; TF = True fir; SAF = Subalpine fir; PP = Ponderosa pine; LP = Limber pine; LPP = Lodgepole pine; WWP = Western white pine; ES = Engelmann spruce; WH = Western hemlock; WL = Western larch; WBP = Whitebark pine

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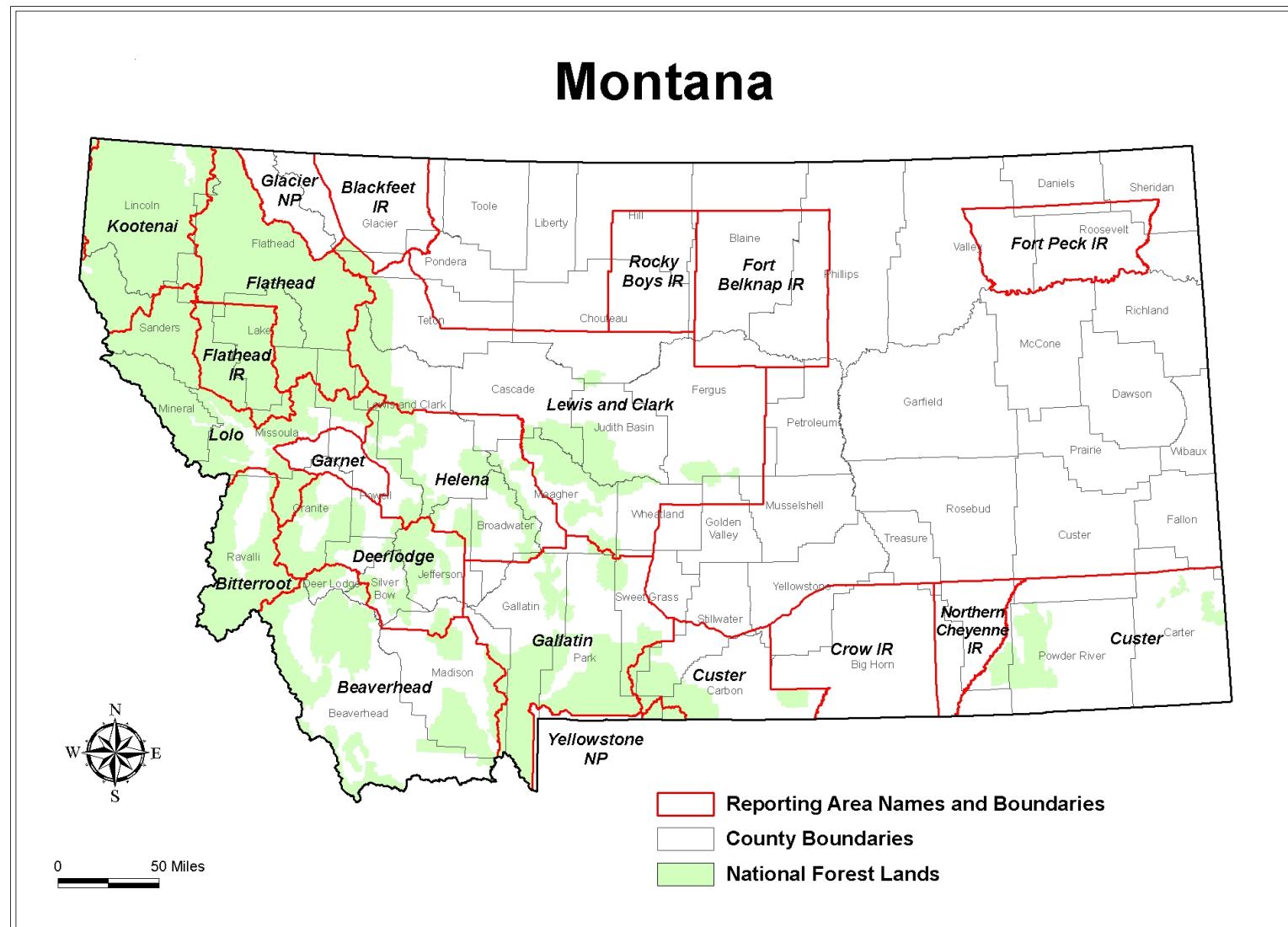
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Figure 1. Reporting Areas and County Boundaries in Montana



**Figure 2. Areas Surveyed In 2011 Forest Health Protection Aerial Detection Survey in Montana**

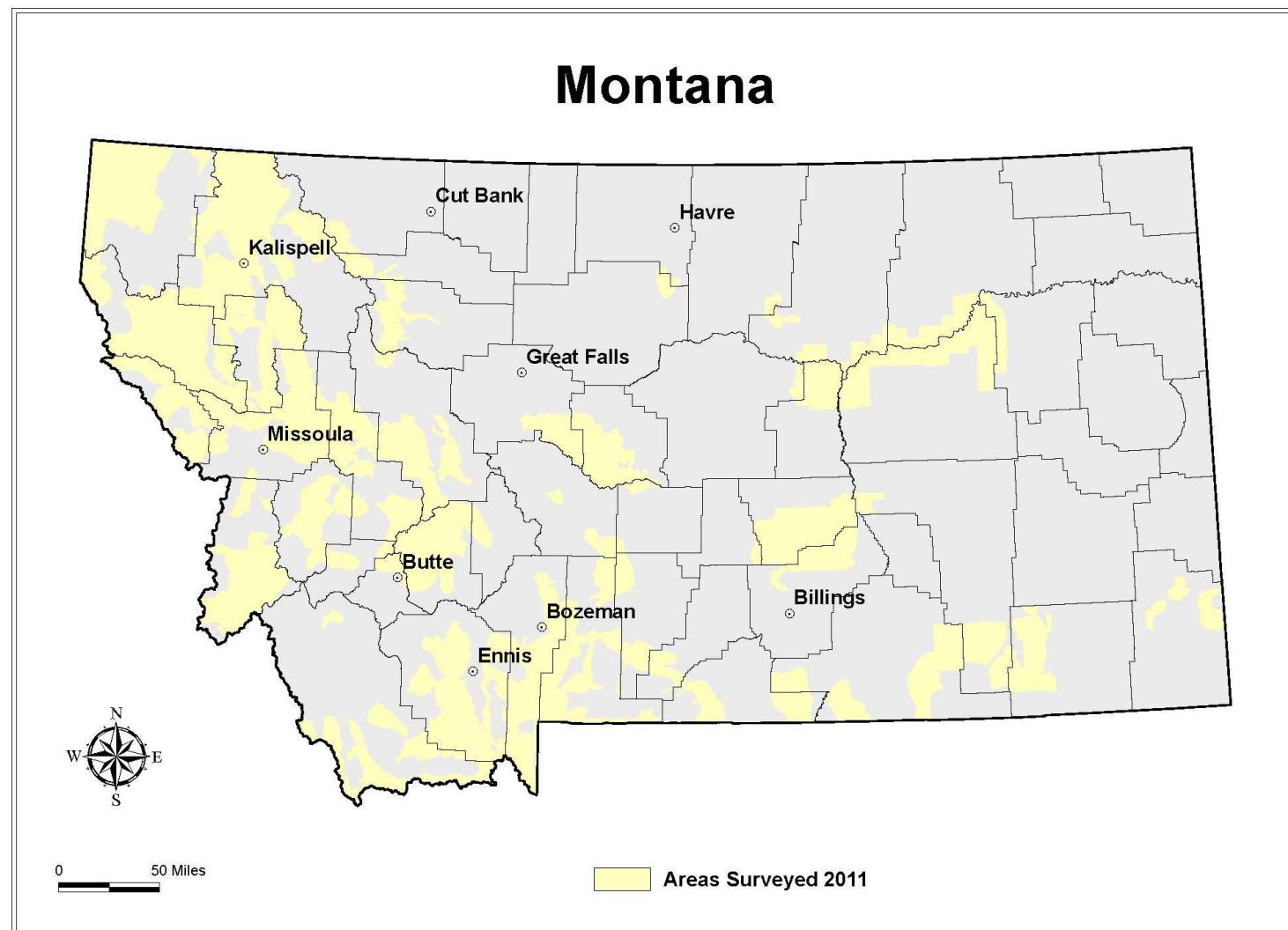


Figure 3. 2011 Mountain Pine Beetle Infestations in Montana

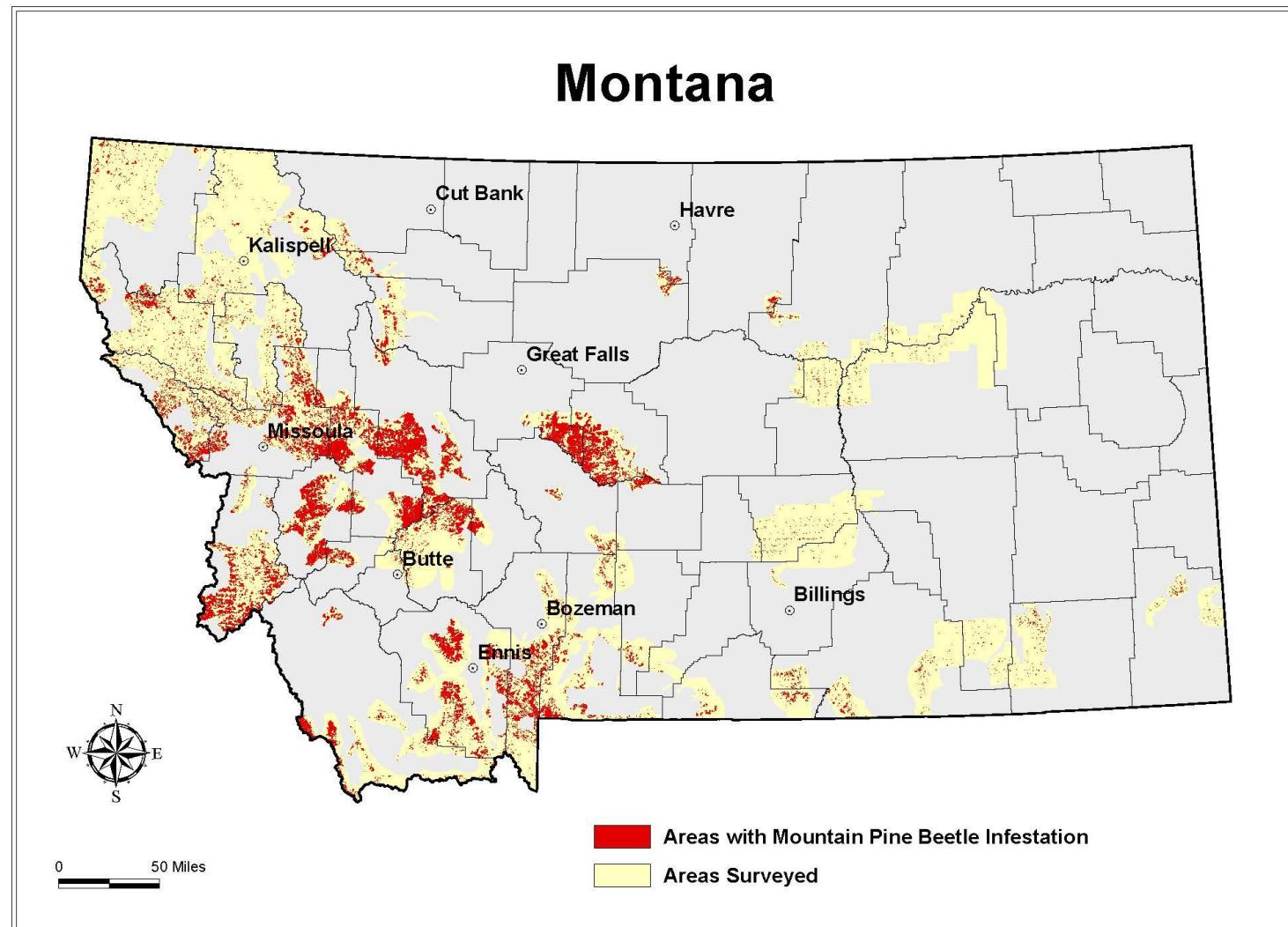


Figure 4. 2011 Douglas-fir Beetle Infestations in Montana

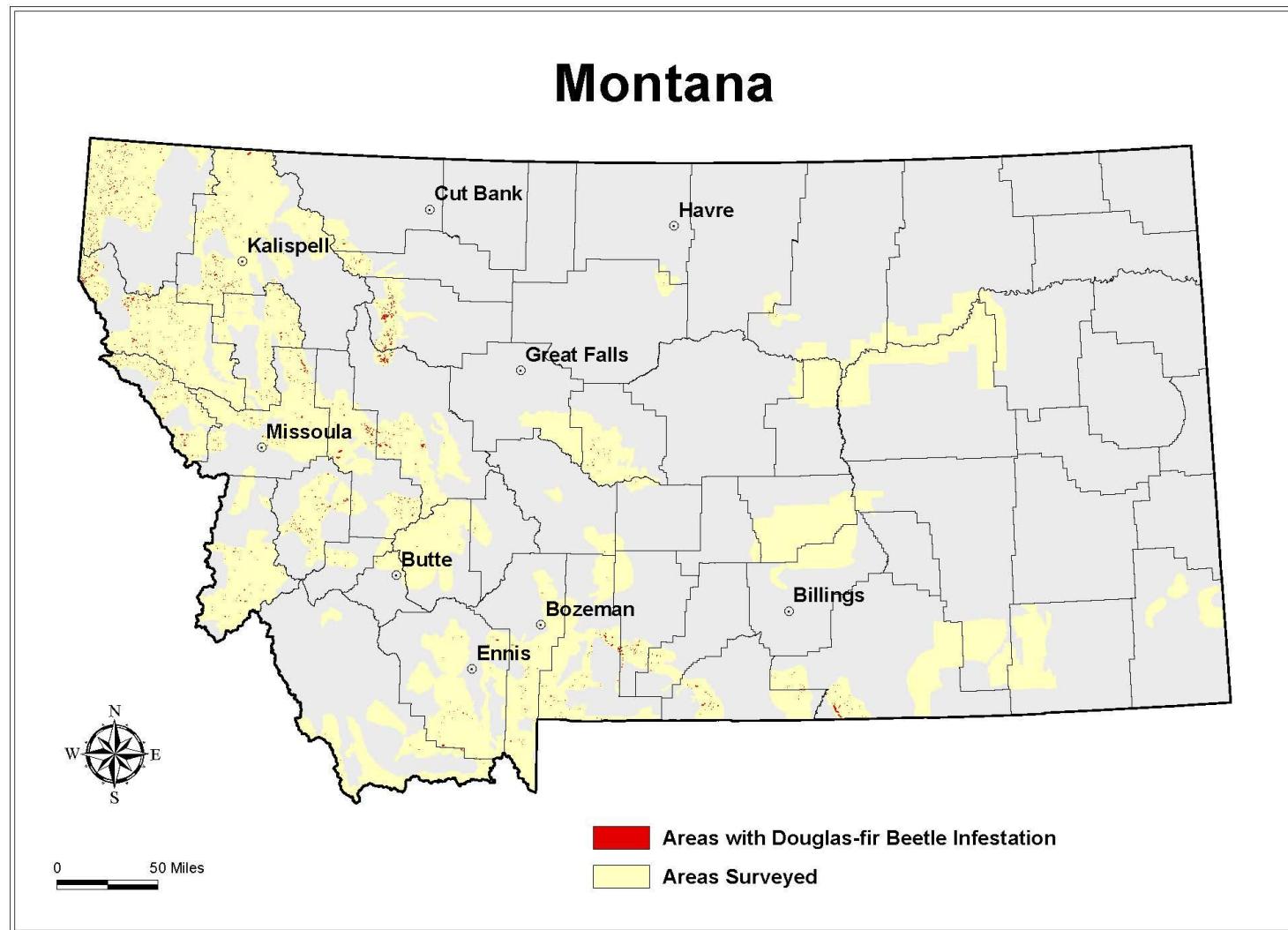


Figure 5. 2011 Fir Engraver Beetle Infestations in Montana

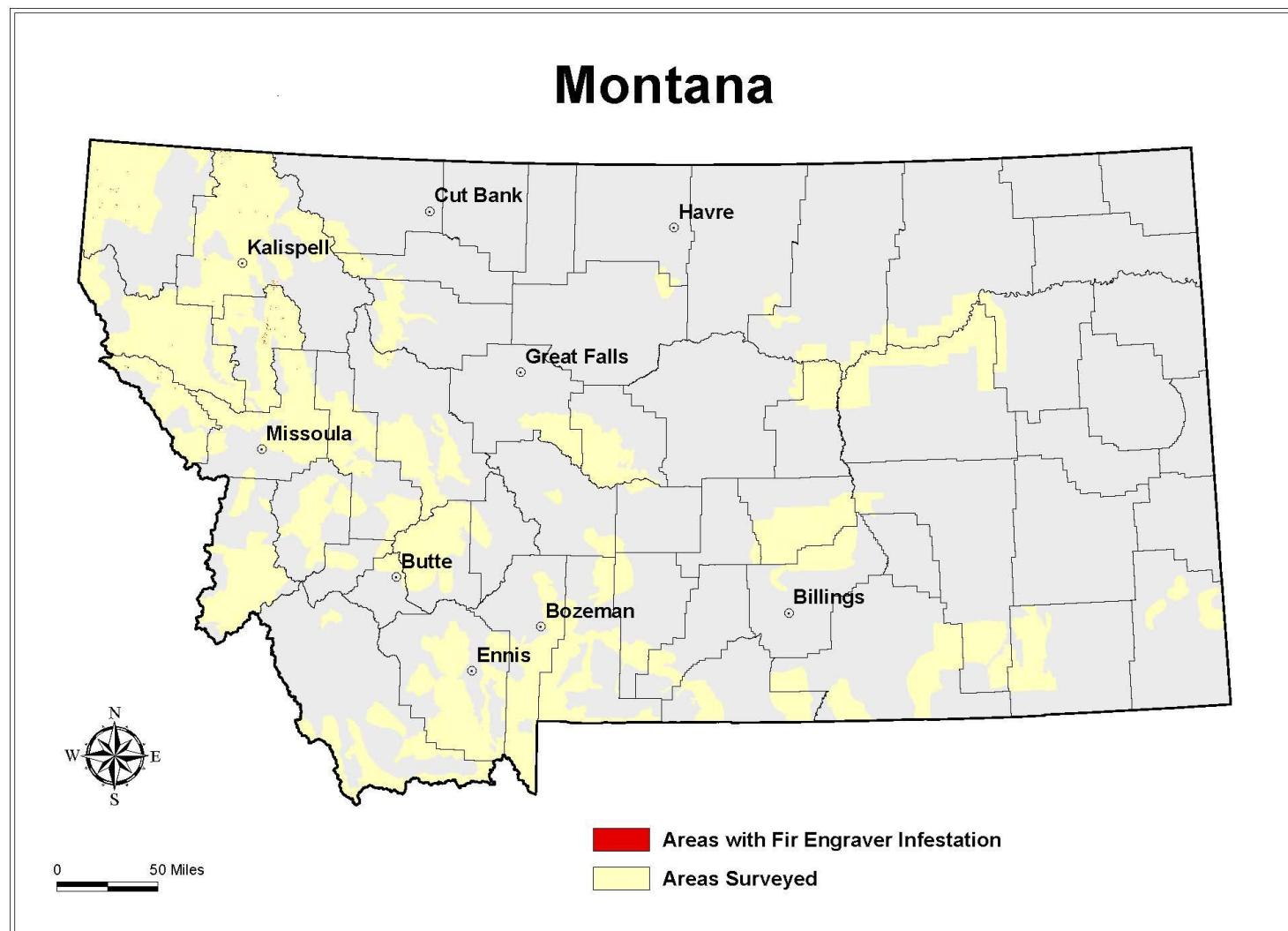


Figure 6. 2011 Subalpine Fir Mortality Complex in Montana

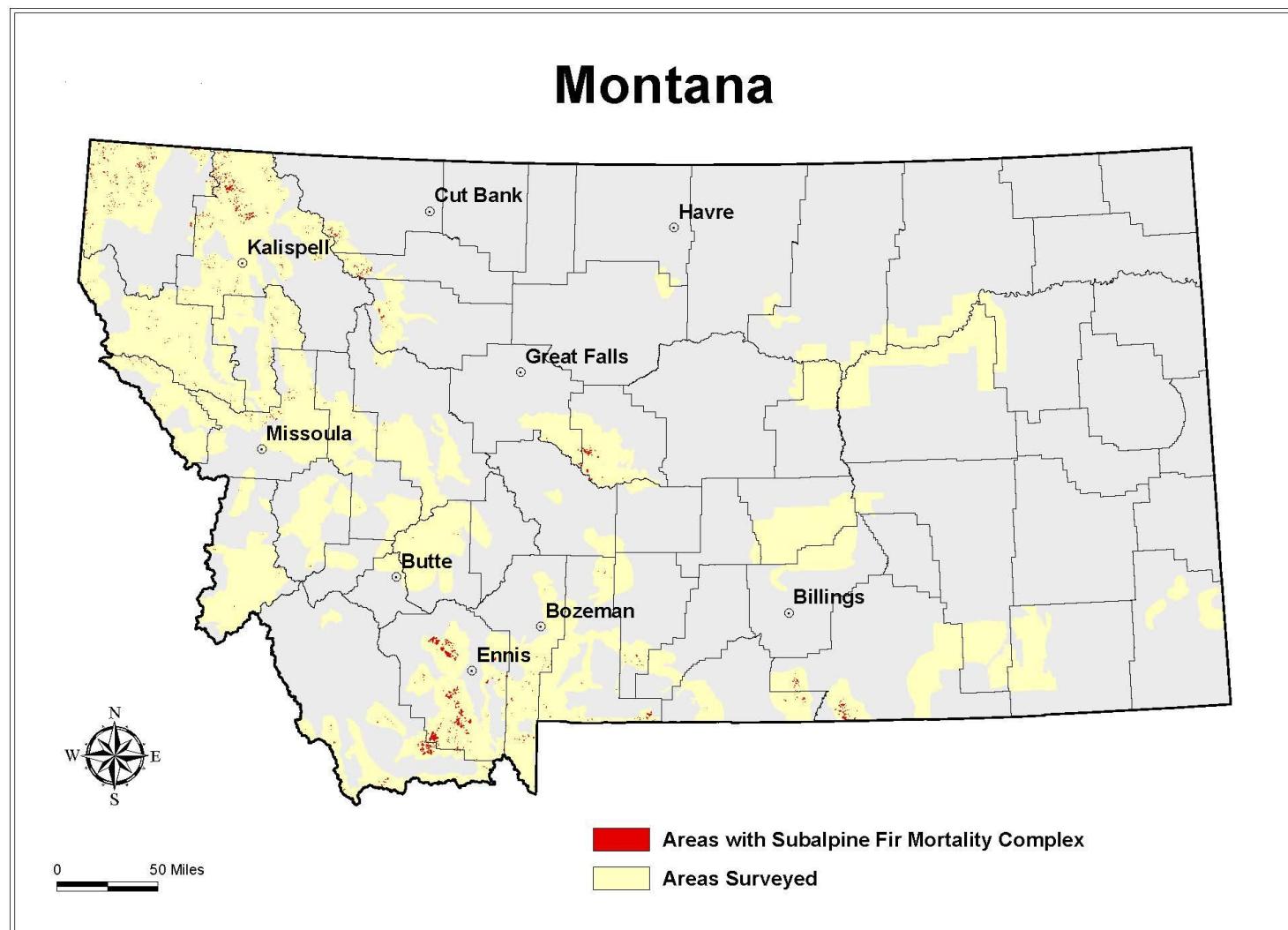


Figure 7. 2011 Western Spruce Budworm Infestations in Montana

